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The Little Researcher

Carl G. Hartman

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Meeting of the Council of the AAAS

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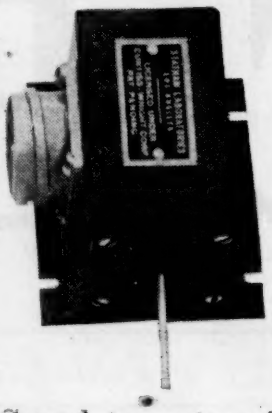

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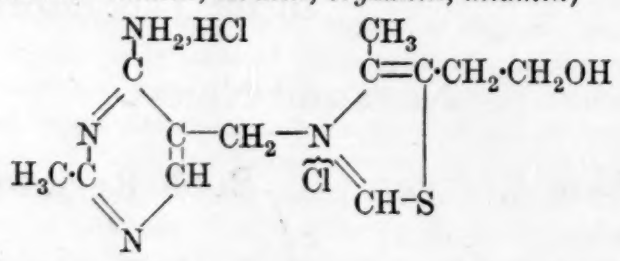

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SCIENCE

Vol. 103, No. 2678 Friday, April 26, 1946

The Little Researcher

Carl G. Hartman

Retiring Vice-president, Section F, AAAS, and *Professor of Zoology, University of Illinois*

IT HAS BEEN RIGHTLY SAID that war does not favor the discovery of new principles in science, although, superficially, we seem to make progress through the exigencies of war at greatly accelerated speed. But science in wartime is largely technology. Gadgets are refined to almost unbelievable delicacy.

Many people do not seem to understand this basic fact. The Bush Committee's slogan, "Back to Basic Research," was emphasized for physics and chemistry, but did not extend to biology; for the report did not recognize that medicine and agriculture are applied or "technological" sciences. The men who wrote the report failed to grasp the fact that medicine and agriculture would languish if basic biology dried up, just as engineering applications would cease to prosper if pure research in physics and chemistry were stifled. In the compromise Kilgore-Magnuson Bill (S. 1850), we as biologists are glad to note that the biological sciences are recognized—at least on paper—on a par with the physical sciences.

When we view our national pre-eminence in the fields of applied science, *i.e.* in technology and "Yankee inventiveness," we should not forget that until recently we have been borrowers from Europe, and particularly from Germany, of the basic principles upon which our most cherished gadgets, the automobile, the airplane, and the radio, depend. With a large part of Europe suffering a severe setback in research, we must take over; otherwise, applied research, which provides better and more useful things—and also jobs—will gradually dry up.

Our Government is wise, therefore, in taking steps to stimulate both pure and applied research. America must organize its scientific talent into as effective a machine as possible. Congress is struggling with this problem. Many are concerned, however, lest the "control" of research be centered in an irresponsible governing board which will administer the law in a spirit of authoritarianism. Without freedom of thought, initiative and originality will be stifled. No group of men is endowed with omniscience, or the clairvoyant gift of knowing in which direction science will sometime advance; indeed, while scientists may plan an attack on a problem through a series of experiments and observations, the results may lead them into unexpected and unforeseen highways. Even the wise manager of industrial research will give a maximum of freedom consistent with the objectives of a given laboratory, which are necessarily more of a short-range order. But there should be no difference in the basic training for either pure or applied research; for if one accepts a place on a team, it is his duty to help carry the ball to the common goal.

The chief function of the Federal Research Board—the "National Science Foundation" of the new Kilgore-Magnuson Bill—will be the placing of financial support where the prospect of returns seems most certain. This is a great responsibility; How it will be met is the concern of all the people. I have a very modest suggestion involving only 1 or 2 per cent of the hundred million dollars recommended for the annual budget of the Foundation. It is my recommendation that 1 or, at most, 2 per cent be apportioned to the Little Researchers, of whom there are thousands, chiefly instructors of science in the small colleges. Just as it is agreed that the Little Business Man is a powerful factor in our economic life, I hold that the Little Researcher constitutes a not inconsiderable factor in the development of scientific research in the United States, as elsewhere. I speak chiefly from the viewpoint of the biologist, but am of the opinion that what I say is also true of the physical sciences and the social sciences.

Colleges and universities are the training schools of researchers and are the source of the available research personnel. They are the home of research and, although much research has been transplanted to industry and to endowed research institutes, these must always look to the universities for their trained investigators and their research directors.

It is hard to realize how recent these developments

Address delivered at St. Louis, 29 March 1946, before the American Society of Zoologists and Section F, AAAS.

are! As Dr. Harlow Shapley said in his testimony at the U. S. Senate hearings on the Kilgore Bill: "It's been only a few years that we were in a position to say to our scientists, 'At least half of your time and responsibility are to be devoted to original investigation in your field of science.'" The Johns Hopkins University, founded in the 1880's, was the first university in the United States to be organized on the German plan, which provided for teaching and research as dual functions of all of the members of the faculties.

The transfer of research to large industrial corporations is a still more recent development, for at the beginning of this century there were exactly three "industrial" scientists; this clan now numbers 70,000.

The universities which took the lead in providing opportunities for research and teaching were at first the richest and strongest. Today the number of colleges and universities runs into the thousands. Dr. R. Walters, in *School and Society,* 6 December 1939, lists about 100 "large" and 400 small universities and colleges. These are the "upper 500" in the college field. In the first group of Walters' classification 700,000 students are taught by 50,000 teachers. In the 400 smaller four-year Colleges of Liberal Arts and Sciences listed by Walters, 240,000 students are taught by 22,000 teachers. These professors, together with 8,500 teachers in technological schools and 5,000 in teachers' colleges, constitute quite an array—over 75,000—of potentially qualified researchers.

In addition to the schools mentioned, there are a thousand weaker institutions of "higher learning" which serve as best they can in the neighborhood of another 25,000 young people.

What is the status of research in these colleges? Certainly the larger universities—Walters' first 100, let us say—possessing the pick of the personnel and almost limitless equipment, will, except for isolated cases, lead in research output. An examination of abstracts of papers published in the *Proceedings of the American Society of Zoologists* shows that teachers in the larger universities write most of these. The same holds for the American Botanical Society. This may be due in part to the fact that the small-college teacher does not attend national meetings.

In proceedings of state and local academies of science the small-college teacher makes a somewhat better showing. About one-third of the articles come from the many small colleges and high schools of the state, while the three large universities, Chicago, Illinois, and Northwestern, contribute 42.7 per cent, and professional schools, 10 per cent.

If research has been an essential and axiomatic function of large universities for less than a century and of industry for half that period, why not interpret this movement as a trend that will presently extend to the smaller colleges, which we are now prone to think of merely as teaching institutions?

A prime hindrance to research is the heavy teaching schedule usually imposed upon the teacher in the small college. In some instances only a superman could carry the load and, in addition, even think of research problems. Paradoxically, it is these selfsame institutions that pride themselves on their pedagogics, claiming superiority over big universities because of "personal attention" to the student. Personally I would rather send my son or daughter to a university where a class of 500 is divided for laboratory and quiz purposes into sections of 20 to 24 students conducted by enthusiastic instructors who know their subject thoroughly—a condition which a live department seeks to maintain—than to a small institution where the overworked instructor has to hop with superficial preparation from one subject to another all day long and sometimes at night. Such a condition is, of course, an extreme but all too common one.

SOURCES OF ILLINOIS STATE ACADEMY CONTRIBUTIONS* 1935–1944

Year	Small colleges and high schools	Large universities	State surveys, museums, and gov't bureaus	Professional or nonacademic	Total
1944	4	11	3	4	22
1943	16	17	11	6	50
1942	33	43	9	4	89
1941	27	52	5	9	93
1940	28	41	11	4	84
1939	23	42	15	11	91
1938	21	30	12	8	71
1937	48	29	11	7	95
1936	25	25	18	12	80
1935	29	40	19	9	97
	254	330	114	74	772

* Acknowledgment is made to Miss Dorothy Rose, editor for the Illinois State Academy of Science, for this tabulation.

Often the inability of the biology professor to distinguish genuine learning from superficiality is shown in the way the teacher stuffs his catalogue with courses. I have before me the catalogue of a college of 200 students whose Biology Department is manned by one man who presides over 33 courses, 6 of which are given at night! I know of a teacher who had a vacant period which he used to work with his small rat colony. When the president found this out, he assigned him a class at his "vacant" period, while the teachers who loafed or rested in their vacant periods continued to loaf or rest.

Such conditions are usually the fault of the college

president. "Let the big centers of learning attend to the research," he is apt to say; "we have the world's teaching on our shoulders."

That this attitude is inimical to the best interests of his college I shall attempt to prove by showing that research makes for (1) perpetual youthful enthusiasm on the part of the college teacher for his subject and its dissemination, which enthusiasm is (2) "catching" to the student and (3) worth while in itself.

The first two arguments for research on the part of the college teacher are closely related, for the saying, "As teacher, so pupil," is as true today as it was yesterday. The argument that a person is a good teacher because he takes no interest in research is most inane, although it is likewise foolish to claim that a successful researcher is always a good teacher. An astoundingly large proportion of graduate students come from certain small colleges through the personal influence of certain professors. Such professors may not always publish extensively, but they, with their students, are continuously reconnoitering along the frontiers of learning.

The extent to which the small college contributes students to the graduate schools of the larger universities is indicated in these figures: Among the 12,000 college graduates who took the Graduate Record Examination the first five years (these were given in the years 1937–1942) 500 colleges were represented. It would be interesting to analyze these data. It is high time that the contribution of the small college in awakening our future science personnel be more fully recognized.

In his clever but, through overstatement, misleading book, *Teachers in America,* Jacques Barzun contends (p. 202) that, where there is emphasis on research, "parents and students must be reconciled to indifferent teaching as the rule, and men choosing the academic career must either give up hope of advancement or be master-jugglers in their early years, at the cost of other good things of life—health, friendship, and contemplation."

But let us be reasonable. Everything may be abused, and in places there may be undue emphasis on research. Cases of neglect of students by the Big Researcher are well known to all of us. Nevertheless, I do hold, and have seen it happen, that "the man who ceases studying at 25 is a dried-out and dull teacher 10 years later." It is unfortunate that just such driftwood all too often gravitates to elementary instruction, to the great detriment of the student as well as the subject. On the other hand, one of my friends, a very productive researcher, who recently left a research institute to join a small college, writes me that he is happy to be back at teaching and especially happy that at the end of his first year a half dozen students upset tradition by doing research with him. The new idea is the talk of the campus.

Research may also be used in elementary courses, as, for example, in the project method described in the October 1926 *Anatomical Record* by Dr. Madeleine Grant, of Sarah Lawrence College, or the "optional experiment" which my colleagues, Steggerda and Gray, described in the February 1940 *Journal of Higher Education* and which they have used with considerable success in an elementary, five-semester-hour course in mammalian physiology.

The intellectual awakening which the college student experiences in the favorable environment has great social value. It devolves on the small colleges, partly because of their number and strategic position of nearness to the people, to help recruit scientists. Because of the war there is a deficit of 150,000 students of science and technology who would have received the Bachelor's degree. It has been estimated by the Bush committee that by 1955 the deficit of those holding advanced degrees will be about 17,000. One of the objectives President Roosevelt had in mind in instructing the Bush committee to study the science situation in America concerned the discovery of scientific talent. He used the following language: "Can an effective program be proposed for discovering and developing scientific talent in American youth so that the continuing future of scientific research in this country may be assured on a level comparable to what has been done during the war?" With one accord we all say: "Of course it can."

When I was in Russia in 1935, attending the International Physiological Congress, I found the enthusiasm among the young scientists perfectly electric. We can do the same, for we have a good start.

I fully realize that research has some of the attributes of the creative and requires what has been called the scientific imagination. The urge must come from within. Perhaps there are industrious teachers of science wholly lacking in this who yet can hardly be said to have missed their calling. I cannot help believing, however, that anyone reading "critically and voluminously" (presumably as a substitute for research?), as Barzun suggests, wil sooner or later become aware of the fragmentary nature of his knowledge and experience a curiosity about methods of finding out things he does not know.

We do not expect to find geniuses everywhere in science departments of either the large universities or the small colleges. Very rarely architects of the framework of science, like Faraday or Pasteur or Darwin, appear either in a large or a small university. But there would be no architects if the day laborers of sci-

ence were not adding stone on stone and sand-grain on sand-grain to the building. For no generalization was ever grasped out of thin air, but was based on the multitude of facts laboriously collected and recorded in print by the "hod carriers" of science.

Even a small study may have, to the researcher, broader implications than appear on the surface. I recall my first publication. My chief, the late Dr. T. H. Montgomery, was writing a monograph on a genus of spiders and had to find out if the number of teeth on the claws of spiders was a reliable specific character. The result was my paper on "Variability of the number of teeth on the claws of adult spiders"—on the surface, about as unimaginative a piece of work as possible. Yet it put me in touch with the universal principle of variation, the raw material of evolution; I learned something of taxonomy; and I got interested in spiders—all this by working concretely on a small problem. Certainly nobody reading the paper would derive any inspiration therefrom; but it did settle one small point for Dr. Montgomery, and that infinitesimal part of the world's work was done. We should not criticize any piece of research because it is small but only because it is not well done, if that is the case.

I hope I have made out a case for the Little Researchers—the science teachers in the small colleges constitute an army of actual and potential researchers. In this I seem to have the support of the Bush committee, which says, speaking of the small-college, "non-research institutions":

> In developing a program of postwar federal aid to scientific research, attention should be given to the potentialities of these schools. To the extent that one sample is representative, at least 40 per cent of the small liberal arts colleges in this country are desirous of conducting research, and are prevented from doing so by lack of funds.

I therefore ask for the Little Researcher a small part of the sum about to be appropriated by Congress for the stimulation of research. I would ask for only 1 per cent of the annual appropriation contemplat in the Bush report. One per cent sounds like a mo proportion, but it is in fact a huge sum compared w past and present sums available. In this connect I am reminded of the fund which the Illinois Acade of Science has had to dispense for research, a s which by common consent went annually to men the smaller colleges. In 1943, when I served as ch man of the committee, we had the munificent sum $213.37 to dispense! This was divided among th men and was much appreciated far beyond the amo of money involved.

By way of contrast, research now runs into money. The troublesome 200-inch reflector for the Palomar Observatory will cost considerably over 000,000; Dr. Lawrence's cyclotron at the Univers of California has cost about the same; the Illin legislature has appropriated out of state funds sum of $1,700,000 for the University's "betatron," electron accelerator; the expenditures of the Yer Laboratories of Primate Biology, devoted to researc on the chimpanzee, are approaching the $750,000 ma It is apparent to anyone who looks into the matt that the bulk of moneys must be concentrated for b things in the big laboratories. Broadly conceive long-time programs are no longer one-man jobs, b require teams and cooperation, in attacks even up single problems, of scientists possessing informati in a variety of fields. Basic biological researches r quire more and more the collaboration of the physici and the chemist with the biologist. Many research now require expensive equipment beyond the imag nation of scientists of 50 years ago.

I therefore agree heartily that the bulk of publi funds for research must go to the large centers. A the same time I do contend that a small part of th new financial aid should trickle down to the Litt Researchers scattered widely over the country. I pre dict that the results of aid to these one-man organi zations will amply justify the outlay.

Scanning Science—

The professor of mineralogy in Harvard University one day observed two young women examining his mineral cabinet, one of whom was evidently searching for some particular species. Offering his help, he found that the object of her quest was feldspar. When shown the mineral she seemed very much interested in the specimens, expressing herself as gratified at having the chance to see and touch them. The professor asked her why she so desired to see th particular mineral. The answer was that for some years she had been obliged to teach in a neighboring high school, among other things, mineralogy and geology, and that the word feldspar occurred so often in the text-book that her curiosity had become aroused as to its appearance.

—24 April 1896

Technical Papers

istemperoid Virus Interference Canine Distemper[1]

ROBERT G. GREEN and CYRIL S. STULBERG
Department of Bacteriology and Immunology
niversity of Minnesota Medical School, Minneapolis

Serial passage of the canine distemper virus through rrets has been shown by Green (*6*) to reduce its rulence for foxes and dogs so that it produces a ld immunizing distemperoid infection when injected to these animals. In 1938, when the distemperoid rus was first used to eliminate distemper from the rge Fromm herds of silver foxes (*7*), it was noted at numerous fox pups exposed to fatal infections pparently were cured in the early stages of the fection. Veterinarians trying out the new distemper ccine in dogs sometimes injected it first into monrels sick with distemper and observed that the vacine, instead of exaggerating the infection, seemed to ssist in recovery of the dogs. Stader and Slaughenaupt (*15*), in studying the immunizing effect of disemperoid virus vaccine in dogs, observed that upon njecting the vaccine there was an immediate proection against distemper and referred it to a "cellblock" effect. Schlotthauer (*14*) reported that dogs njected with 15 mg. of distemperoid virus did not ontract distemper upon exposure immediately after noculation, but that dogs injected with smaller doses, uch as 7.5 and 2.5 mg., did so.

The interference phenomenon in animals was first bserved, independently, by Hoskins (*9*) and by Magrassi (*12*) in 1935. Magrassi reported an interference between nonencephalitic and encephalitic herpes viruses in rabbits, while Hoskins demonstrated interference between neurotropic and pantropic yellow-fever viruses in monkeys. Findlay and MacCallum (*5*) confirmed and extended the work of Hoskins and were able to show that the Rift Valley fever virus protected monkeys against pantropic yellow-fever virus, while the neurotropic strain of yellow-fever virus protected mice against the Rift Valley fever virus. That the virus of lymphocytic choriomeningitis protected monkeys against a virulent monkey strain of poliomyelitis virus was demonstrated by Dalldorf (*3*). Jungeblut and Sanders (*11*) showed that the virus of murine poliomyelitis, also, protected monkeys against virulent monkey strains of poliomyelitis virus, and recently Jungeblut (*10*) has made extensive studies of the factors governing the phenomenon.

Andrewes (*1, 2*) noticed an interference between virus III and the virus of Shope fibroma in rabbits and later used tissue cultures to demonstrate that a strain of influenza A virus interfered with the growth of a neurotropic variant of that virus. Subsequently it was shown by the Henles (*8*) and by Ziegler, Lavin, and Horsfall (*16*) that interference occurs between the viruses of influenza A and influenza B, between these and swine influenza virus, and between inactivated and active influenza viruses; the antagonistic effects of these viruses on one another were observed in embryonated eggs. The interference phenomenon between bacterial viruses has been studied extensively by Delbruck and Luria (*4*), while studies made by workers on similar phenomena between plant viruses have been reviewed by Price (*13*).

We have now obtained experimental data to establish that the ferret-passage virus will, upon intramuscular inoculation, interfere with the course of a distemper infection established by nasal inoculation with a highly virulent distemper virus. In one of our experiments, 40 red fox pups were divided into groups of 10 and each group was inoculated as follows: Group A, as a control group, received virulent distemper virus only. Group B was inoculated with virulent distemper virus and distemperoid virus simultaneously. Group C received virulent distemper virus first and distemperoid virus 3 days later. Group D received virulent distemper virus first and distemperoid virus 12 days later.

The virulent distemper virus was prepared for inoculation from frozen, infected fox spleens. The ground tissue was diluted to 25 per cent in Ringer's solution, and each fox was inoculated intranasally with 0.4 cc. (100 mg.). The distemperoid virus was ferret-passage virus of the sixty-third generation in ferrets, frozen as 25-per cent homogenized ferret spleen in horse serum. In all cases, 200 mg. was inoculated intramuscularly into the legs of the designated foxes. The animals were observed daily for symptoms of distemper. A necropsy was performed on animals that died from the infection, and smears were made of the epithelial cells lining the bladder and the trachea. In every dead animal typical cytoplasmic inclusions characteristic of distemper were seen. Results observed for the different groups of animals are as follows:

Group A. On the sixteenth day following the inoculations of virulent distemper virus, all animals in

[1] Aided by a grant from the Graduate Medical Research Fund of the University of Minnesota and by experimental facilities and financial support furnished by Fromm Laboratories, Inc., Grafton, Wisconsin.

the control group exhibited marked symptoms of distemper. The first death occurred on the twenty-fifth day, and at the end of 36 days all the animals in this group had died of typical distemper.

Group B. In this group, which was inoculated simultaneously with virulent distemper virus and distemperoid virus, 2 foxes showed symptoms on the sixteenth day. By the twenty-third day, 5 animals showed some symptoms of distemper. However, they recovered promptly, and by the thirty-first day all appeared well.

Group C. In the group receiving distemperoid virus 3 days after the inoculation of virulent distemper virus, only 2 foxes showed symptoms. These became sick on the twenty-third day and were normal again on the thirty-first day.

Group D. One of the animals receiving the distemperoid virus 12 days after the virulent distemper virus showed symptoms on the nineteenth day, and 4 of this group showed symptoms by the twenty-third day; all had recovered by the thirty-second day.

The decisive results obtained in this study are further accentuated by the fact that foxes seldom recover from distemper once they have exhibited any symptoms whatsoever. In this case, the distemper virus used was a fox-passage virus of high virulence for that animal. From the results, it seems definitely established that there is a marked antagonistic effect of the distemperoid virus on a virulent distemper infection, and this effect appears sufficiently significant to be utilized practically in the treatment of distemper. In fact, in this experiment the antagonistic effect of the distemperoid vaccine was just as great when the ferret-passage virus was used 12 days after inoculation of virulent virus as when it was used within an hour after such inoculation; and in both cases the distemperoid vaccine prevented any fatalities. Our results corroborate our earlier clinical observations on foxes and those of Stader and Slaughenhaupt on dogs, as well as the experimental observations of Schlotthauer. In addition, a definite therapeutic effect of the modified virus on the virulent infection seems demonstrated for the incubation period and early stage of the infection. Thus, it appears that a modified virus may be useful for both the prevention and the therapeutic treatment of a disease caused by a virulent strain of the same virus.

Summary

A distemper virus modified by ferret passage so as to become a harmless vaccine for foxes and dogs exhibits the interference or cell-blockade phenomenon with respect to a virulent distemper infection in foxes. Ten control foxes receiving virulent distemper virus died, while 30 foxes receiving distemperoid vi in addition lived.

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Availability of Carotene From Kale

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Measurement of the vitamin A value of vegetable presents considerable difficulty. Figures quite di proportionate to known biological values have bee reported by various investigators for the chemic determination of the carotene content of certain veg tables. Different vegetables of equal carotene conte have been found to vary in their vitamin A value a determined by biological assay. This fact has led t the assumption that when carotene is ingested in th form of vegetable foods, it is less effective than whe taken in pure form. It has, at times, been suggeste that the discrepancies may be explained by the known inaccuracies of the biological estimations, coupled wit the problem of obtaining representative samples. However, it is unlikely that the errors of all worker in this field should be consistently in the same direction. Therefore, the true relationship between the carotene content of vegetables as measured by chemical analysis and bio-assay is of fundamental importance.

As a part of an investigation on the factors influencing the utilization of carotene from vegetable foods, experiments were devised for the study of kale to determine whether or not digestibility of the vegetable tissue is one of the factors causing these differences. These experiments were designed so that chemical chromatographic analyses for carotene were made of the kale parallel with bio-assays on both the kale itself and an extract of the carotenoids from the vegetable.

Sixty-four chemical analyses were made, and 138 rats were used in the biological assays. Eighteen different lots of kale, purchased on the Washington market, have been used in this study, one bushel being obtained for analysis weekly. Since kale is commonly eaten by human beings in the cooked form, the analyses were made on cooked kale. In addition, cooking the kale served to inactivate the enzymes destructive of carotene, thus eliminating one factor that is impossible to control in bio-assays. The kale was thoroughly washed with distilled water and steam cooked. It was then spread on trays, cooled, and a representative sample of appropriate size withdrawn. The leaves were stripped along the midrib so that none of either the midrib or petiole was included. One-half of each leaf blade was removed for the biological assays, and the corresponding half was used in preparing the extract which was analyzed biologically and chemically. The chlorophylls and xanthophylls were removed by saponification with potassium hydroxide, leaving the carotenoid pigments in the solution. Aliquots were taken from the extract for chromatographing and determining β-carotene spectrophotometrically; the remaining extract was concentrated in cottonseed oil containing hydroquinone and was analyzed biologically.

The measurement of β-carotene was accomplished by a procedure devised in our laboratories based on the methods of Moore and Ely (*1*), using acetone, absolute methanol, and Skellysolve F as extractants and magnesium oxide and magnesium carbonate (1:9) as adsorbents.

The biological assays were performed essentially according to the *U. S. Pharmacopoeia* (11th ed.) method using as the standard of reference pure β-carotene in cottonseed oil prepared in our laboratories.

The data shown in Table 1 represent the average vitamin A values of cooked kale as determined on the vegetable itself and on an extract of the kale.

TABLE 1

Description of sample	Chemical assay*	Bio-assay
	IU/gram	IU/gram
Kale, cooked	90	60
Extract of cooked kale	90	84

* Determined as carotene and converted to vitamin A value, using 0.6 μg. carotene as equivalent to 1 international unit.

From these figures it appears that the vitamin A value of kale as determined by bio-assay is about two-thirds of the value measured spectrophotometrically after chromatographing. On the other hand, when the carotenoid pigments are completely extracted from kale and this extract is used as the vitamin A supplement instead of kale itself, the bio-assay gives a vitamin A value of only 6 per cent less than that obtained by the chemical method. This is well within the experimental error of the bio-assay method and near the upper range of error of the chemical method. This evidence suggests that incomplete digestion of the kale, and therefore incomplete absorption of the vegetable carotene in the intestinal tract of the animal, may be an important factor causing the difference between the vitamin A values of kale obtained by chemical and biological methods.

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The Growth and Distribution of Murine Encephalomyelitis Virus in the Developing Chick Embryo[1]

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Gard (*2*) has reported the transfer of Theiler's (*5*) FA "mouse poliomyelitis" virus to the developing chick embryo and propagation through four passages. Using the chorioallantoic technique, Gard demonstrated the presence of virus only in the central nervous system (CNS) of embryos which had been inoculated at the age of five, six, and seven days. In eggs inoculated at eight days of age, no virus was recovered from any site. In no instance was virus discovered in membranes or in the corpus minus the brain and vertebral column. Also, CNS harvested 10 days after inoculation was infective for mice inoculated intracerebrally, but CNS harvested 5 days after inoculation was noninfective when tested in the same manner. In Gard's experiments, all eggs were incubated at 37° C. before, as well as after, inoculation. The inoculum consisted of 0.05 ml. of bacteriologically sterile 10-per cent suspension of infected mouse brain. Gard also was successful in transferring the UFI strain of "mouse poliomyelitis" to eggs.

Jungeblut and Sanders (*3*) reported the successful propagation of a murine neurotropic virus in embryonic mouse brain and embryonic guinea pig brain cultures. Using similar tissue cultures, Parker and Hollender (*4*) also were recently successful in propagating the GD VII strain of Theiler's virus through 20 passages.

In the present work the FA strain of Theiler's

[1] Aided by a grant from the National Foundation for Infantile Paralysis, Inc.
[2] Alfredo Hirsch Foundation Fellow of the National Academy of Medicine, Buenos Aires, Argentina.

mouse encephalomyelitis virus has been grown in fertile eggs and carried through nine generations.

The original FA stock virus was received in this laboratory from Dr. Max Theiler, in the form of glycerinated mouse brain, in 1941. The material used in this experiment was put through two passages in mice in our laboratory and kept frozen at −70° C. in the form of 20-per cent suspension of mouse brain. Sterile distilled water was used as diluent. This strain is nonpathogenic for monkeys but produces the usual signs of encephalomyelitis when inoculated intracerebrally in albino Swiss mice and cotton rats. A titration of mouse brain in the third New Haven passage yielded an ID_{50}[3] titer of $10^{-6.5}$ and an incubation period of 3 to 26 days.

Six-day-old fertile eggs were used, usually from Black Australorps and Rhode Island Reds. Incubation was carried out at 35°–35.5° C. before, as well as after, inoculation. A blower fan type of incubator equipped with a humidifier was used, and a reading of 85°–87° humidity was maintained. The eggs were turned five times daily, before inoculation.

An artificial air space was produced over the embryo, using the method described by Burnet and Faris (*1*). The original inoculum was prepared by grinding infected mouse brain with sterile alundum in cold, sterile distilled water sufficient to make a 10-per cent suspension. This suspension was centrifuged at 2,000 r.p.m. for 10 minutes and the supernate decanted. One-tenth milliliter of this supernate was placed on the dropped chorioallantoic membrane, using a 1-ml. tuberculin syringe and a 25-gauge needle. The opening in the shell over the embryo was then sealed with scotch tape and the small hole over the natural air sac was sealed with nail polish.

In the first three passages, four to six eggs were harvested at both 5 and 10 days after inoculation. Harvests consisted of allantoic fluid, amniotic fluid, chorioallantoic membrane, chick embryo brain, and the corpus minus the CNS. The embryo and chorioallantoic membrane were washed in three changes of cold, sterile saline. The embryo was decapitated, and the vertebral column was excised and discarded. Ten-per cent suspensions of tissues and membrane were made by grinding with sterile alundum in cold, sterile distilled water. These suspensions and the allantoic and amniotic fluids were centrifuged at 2,000 r.p.m. for 10 minutes and 0.03 ml. of the supernatant fluids were tested by intracerebral inoculation in four- to five-week-old Swiss mice. All test animals were observed daily during a period of four weeks. For passage to other eggs, 0.1 ml. of a 10-per cent suspension of chick embryo brain, harvested 10 days after inoculation, was used.

[3] ID_{50} = infective dose that produces the disease in 50 per cent of mice inoculated.

Materials harvested at both 5 and 10 days after inoculation, when tested intracerebrally in mice showed the virus to be distributed somewhat irregularly throughout the egg. Also in our hands, the distribution differed from the results reported by Gard (see Table 1). The greatest concentration of

TABLE 1

Materials tested	1st Passage		2nd Passage		3rd Passage	
	5 days Inc.	10 days Inc.	5 days Inc.	10 days Inc.	5 days Inc.	10 days Inc.
Allantoic fluid	4/8*	0/8	8/8	5/8	1/5	5/5
Amniotic fluid	1/6	7/8	5/7	8/8	5/5	2/5
Chorioallantoic membrane	7/8	5/8	8/8	7/7	3/5	5/5
Brain	2/8	7/8	0/8	7/8	0/5	4/5
Corpus minus CNS	8/8	8/8	1/8	7/7	5/5	5/5

* Numerator represents the number of mice which became infected; denominator represents the number of mice inoculated.

virus in the egg, as judged by the incubation period and morbidity incidence in inoculated mice, appeared to be present in the corpus minus the CNS after an incubation period of 10 days. The smallest concentration appeared to be in the brain, after 5 days' incubation.

A distribution study in harvests from eggs representing the fourth passage of FA virus has also been made. The results indicate that the virus is also present in the yolk sac, in a somewhat lower concentration than in the corpus minus the CNS.

Because of the similarities between the Theiler viruses and poliomyelitis virus (*5*), we are using the present results as a guide for the propagation in eggs of a rodent adapted strain of human poliomyelitis virus.

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Seed Pitting of the Lima Bean by Lygus Bugs in California

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Lima beans grown in California for dry food, seed, the fresh market, and freezing have for some years shown a pitting of the seeds indistinguishable from that attributed to yeast (Nematospora) in the southeastern United States (*10*). However, no Nematospora or other pathogen has ever been found in lesions

California material. The injury may be a discored spot centering on a minute feeding puncture, t in more severe cases or when several such spots alesce, an open corroded pit is evident in the seed t and cotyledon. Such injuries have been called hid spot, yeast spot, or seed pitting by growers and ppers. Accompanying this condiiton is the shedng of blossoms and of pods up to two inches or re in length. The pods which wilt, turn yellow, and scise are termed "buckskins" by growers and have en attributed to other causes, such as heat injury, to steaming from irrigation after the vines have vered the ground. Pods containing pitted seeds nnot be detected positively by external examination one. However, they frequently exhibit internal proerations and brown areas, some of which contact e pits of the seeds.

These several types of injuries have now been monstrated to result from the toxic feeding of ygus bugs (*Lygus hesperus* Knight, *L. elisus* V.D., nd perhaps others) on the developing fruiting strucres of the Lima bean plant without the involvement pathogenic microorganisms. It seems desirable at is time to clarify the situation in California, the ading Lima-bean-producing area of the country, and indicate the impossibility of distinguishing this ouble, solely on the basis of symptoms, from that ttributed to yeast.

Pitting of field-bean seeds apparently was first eported (*2*) in Michigan in 1895 and shown to be a sult of Lygus feeding. This relationship has been nfirmed in New York (*3*) and Idaho (*5*) and has een shown to occur also on the baby Lima bean in he latter state. Specimens of injured California eans submitted to W. E. Shull were said to be idenical with those which resulted from Lygus feeding in daho. Pitting was reported (*1*) on Lima beans from alifornia in 1922 and was attributed, apparently on he basis of symptoms, to yeast spot. That the seed itting, and blossom and pod drop of Lima beans in alifornia actually resulted from Lygus feeding was irst suspected by the writers following visits to fields n Ventura County in August 1944, and subsequent ork has confirmed this relationship. Such injury has een observed on large and baby Lima bean and blackyed cowpea, but not on common bean.

Fields with severe blossom and pod drop tend also o have abundant seed pitting and, in Ventura County, a high incidence of Lygus bugs. In some areas, however, the Lygus populations late in the season may become too low to account for the evident damage initiated earlier. The injury has been worst in fields adjacent to seed beets and to alfalfa, particularly after it is cut. Damage also has been worst in parts of Lima bean fields closest to these established, favorable hosts of the insects, and within such areas the loss commonly diminishes with distance. The first crop of pods are not usually injured, but with the high Lygus populations of midsummer, much pod shedding and seed pitting occurs.

Lygus bugs commonly feed on flowers and fruits or seeds and are known to cause severe blossom drop on alfalfa (*8, 9*) and cotton (*6*) and to reduce germination of beet seed (*4*); they have been shown (*7*) to be highly toxicogenic. The observed facts in California are in accord with published data on the injuries produced by these insects on various plants, including common and Lima beans.

Experiments in which Lygus bugs were caged on plants in the field and on individual pods in the greenhouse fully confirmed the fact that they produced the various types of injury. Dropping of blossoms and young pods always resulted, and on older pods the internal proliferations and typical pitting of the seed occurred within seven days. Checks remained uninjured. There was no evidence of yeast or other microorganisms in the tissues.

The results establish the fact that the toxic feeding of Lygus bugs is responsible in the California Lima bean crop for a seed spotting and pitting, and for some of the dropping of blossoms and pods. It is possible that other insects also may be involved. Details are being published elsewhere.

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Oral Penicillin X [1]

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A brief resumé of some of the properties of penicillin X and the results of a clinical trial in gonorrhea were recently published by workers of the Food and Drug Administration (*4*). It was shown that, unit for unit, penicillin X is superior to the usual commercial preparations of penicillin in acute gonorrhea and in protecting mice against pneumococcal infec-

[1] Accepted for publication on 12 September 1945.

tion. Simultaneous *in vitro* tests were carried out in this laboratory with commercial lots consisting almost entirely of penicillin G and with preparations containing 65 per cent or more of penicillin X. Most strains of Group A hemolytic streptococci, gonococci, and meningococci were from two to eight times more sensitive to penicillin X; most strains of pneumococcus and of *Streptococcus viridans* were twice as sensitive to penicillin X, and most of the staphylococci were equally sensitive to both forms of penicillin. Levels of penicillin activity in the serum against Strep. 98 were studied and found to be significantly higher and to be sustained longer after intramuscular injections of penicillin X than after injections of the same number of units of regular penicillin in the same subjects (*2*).

Similar studies of the levels of penicillin activity in the serum after oral administration of the two kinds of penicillin have also been carried out. The results were strikingly different and are the subject of the present report.

The methods used and the injectable preparations of penicillin X were the same as in the previous studies (*2*). In addition, tablets of regular calcium penicillin and of penicillin X, each containing about 30,000 I.U. (*3*) with certain adjuvants, were also available for these studies.[2] Subjects A, B, and C were members of the laboratory staff; D, E, and F were hospital patients who had no recent infections and had not recently received penicillin or sulfonamides, but subject F had a duodenal ulcer with normal gastric acidity; and subjects G, H, and I were cases of pernicious anemia with gastric anacidity after histamine injections. All of the oral doses consisted of 90,000 units and were given one-half hour before breakfast. Previous studies have shown that higher, better-sustained, and more uniform serum levels are obtained when oral doses are given before meals (*1*).

The results are shown in Fig. 1. In interpreting these results it must be borne in mind that Strep. 98, the strain used in determining the serum levels, was found to be from two to four times more sensitive to the preparations of penicillin X than to the commercial penicillin used in the present studies. The unitage as recorded on the chart is based on the sensitivity of Strep. 98 to penicillin G: 0.02 and 0.03 units represent complete killing of 10,000 streptococci contained in 0.5 cc. and 0.2 cc., respectively, of undiluted serum, and the other values are based on serial twofold dilutions of 0.2 cc. of serum. The same values are recorded for regular penicillin and for penicillin X.

[2] Injectable penicillin X was supplied by Lederle Laboratories, Inc., and by Cutter Laboratories, the former also providing the tablets of penicillin X. Tablets of regular calcium penicillin were furnished by Hoffmann-La Roche, Inc. Commercial preparations of several brands of regular sodium penicillin were used for solutions.

In each of the six subjects who received the two kinds of penicillin in solution, the effective serum levels were significantly higher and were sustained better when regular penicillin was given. Comparable differences were observed in the normal subjects and in the cases of pernicious anemia. When the tablets

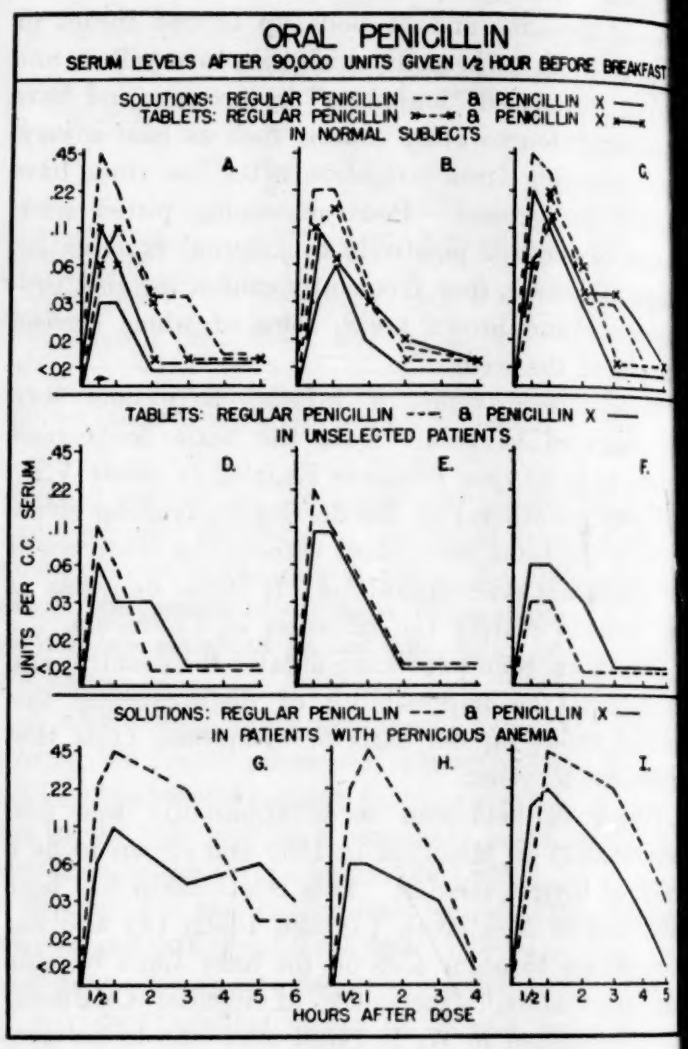

FIG. 1

were given, there was no constant or significant difference in the serum levels after the two kinds of penicillin. Except in subject F, however, the maximum serum levels after the regular penicillin were the same or higher than those obtained after penicillin X. As in the previous study (*1*), higher and more sustained levels from oral doses were obtained in the achlorhydric subjects. In view of the greater sensitivity of the test strain of streptococcus, the higher values obtained after the regular penicillin assume an even greater significance than is apparent from the values shown in the chart.

Conclusions. When measured with Strep. 98, an organism which is two to four times more sensitive to penicillin X than to regular penicillin, the effective levels of penicillin activity in the serum were found to be higher in the same subjects after regular penicillin than after comparable preparations of penicillin

each given orally. The results are in sharp contrast those obtained after intramuscular injections of ese two kinds of penicillin and suggest that penilin X is not absorbed as well as penicillin G after al administration.

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The Beckmann Rearrangement of Aliphatic Ketoximes

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Sidgwick (*8*) states that the Beckmann transformation of methyl *n*-propyl ketoxime results in the formation of two amides, whereas the analogous rearrangement of methyl isopropyl ketoxime gives but one. From this he argues for the existence of steric interaction between the hydroxyl and isopropyl groups of the latter oxime, which would prevent the formation of the alternate amide. This argument cannot hold, because of an apparent oversight in previous literature. Although Beilstein (*1*) gives the above information concerning the two rearrangements, reference to the original paper (*4*) shows that in all cases investigated all possible products were formed from

$$CH_3\text{–}C(=NOH)\text{–}R \qquad \text{I}$$

where R may be propyl or isopropyl as well as ethyl or hexyl. In each of these cases the amide with the configuration

$$CH_3\text{–}CONH\text{–}R \qquad \text{II}$$

was found in the greater proportion, but lesser amounts of $R\text{–}CONH\text{–}CH_3$ were also detected in every instance. Thus, the statement by Sidgwick, "It is unlikely that the electrical fields of the propyl and isopropyl groups are widely different, but the space they occupy in the vicinity of the oxime hydroxyl group must differ," is not necessarily relevant. Kharasch (*9*) has demonstrated that the electrical fields of the methyl, propyl, and isopropyl groups do differ enough to direct the course of certain reactions. Hence, the relative electronegativity of CH_3– as compared with that of R may still be a deciding factor on the course of the rearrangement. This consideration of oximes (I) with R as propyl or isopropyl is important where prediction is to be applied to the course of rearrangement of 2-alkylcyclohexanone oximes (III)

$$\begin{array}{l} CH_2\text{–}CH_2\text{–}C{=}NOH \\ \quad\quad\quad\quad\quad\quad | \\ CH_2\text{–}CH_2\text{–}CHR \end{array} \qquad \text{III}$$

where R may also be methyl. The similarity in structure of (I), where R is isopropyl and (III), where R is methyl, is obvious from the formulas. In most of these cases (*6, 7, 10*) only one of the two possible products is found. However, at least one exception has been found (*11*) which now no longer seems anomalous in view of the corrected statement of earlier findings for methyl isopropyl ketoxime. Unfortunately, no quantitative information was given by Wallach for 2,4,4-trimethylcyclohexanone oxime (*11*), and the identity of the products was not established.

Higman (*5*) has recently presented a mechanism for the Beckmann rearrangement which does not involve the classical migration of groups (see chapter on the Beckmann rearrangement, *8*) but only a 90° twist by C=N in an oxime, followed by a small angular displacement of substituents. With the electronegativity considerations of Degering (*2*) in mind, we may look upon the segment C=N as a dipole with a relatively positive nitrogen atom. The minimum rotation of C=N would then be preferred in the direction of the more negative (greater electron releasing) R rather than toward methyl or methylene (*9*), although some product from the alternate course of reaction would be expected and has been found (*4, 11*). Through similar qualitative considerations Degering was able to predict the course of the reaction of 2-alkylcyclohexanone oximes (*3*) whereby products similar to (II) were formed. It is hoped that this discussion will help to tie together the early and recent work on the rearrangement of aliphatic ketoximes.

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Penicillin Production by a Superior Strain of Mold

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The figures given in this note represent a small part of the data obtained during the course of an investigation of factors influencing fermentation time and yield in penicillin production in submerged cultures, the results of which will be published in more detail elsewhere. It is the purpose of this note to summarize briefly the results obtained when a number of penicillin-producing mold cultures were tested in 80-gallon tanks.

The cultures were isolated by laboratories at Stanford University (Department of Biology), the University of Minnesota (Division of Plant Pathology and Botany), and the Carnegie Institution of Washington (Department of Genetics). These laboratories, as well as our own, carried on penicillin research projects as a part of a program supported by the Office of Production Research and Development of the War Production Board. The testing of the most promising of these strains in tank fermentations at Wisconsin was a part of this program. The tanks used were of 80-gallon capacity and contained 220 liters of medium, 20 liters of which was inoculum grown in a smaller tank under aeration and agitation. The tanks were supplied with air at the rate of 200 liters per minute. Sterile air was admitted through pipe spargers containing 54 holes, each 1/32 in. in diameter. The agitators used were 12-in. propel having two flat blades, set at a 30° angle, and revo ing at 270 r.p.m. The tanks were held at gage pr sure of 20 pounds per square inch during the ferm tation period. The temperature was held at 23° C.

TABLE 1

HIGHEST PENICILLIN YIELDS OBTAINED FROM VARIOUS CULTURES*

Culture number	Source of culture	Highest yield obtained	Age at maximum yield	Comparable yield from culture 1951–B25†
		Units/ml.	Hours	Units/ml.
1951–B25	NRRL	245	64	...
832	NRRL	99	71	214
15–U1	Minnesota	222	68	245
R–38	Minnesota	135	55	172
R–1139	Minnesota	96	74	214
R–1205	Minnesota	191	69	214
1982	Stanford	119‡	64	103
25099	Stanford	244	62	184
35217	Stanford	275	84	245
35347	Stanford	255	72	245
45417	Stanford	229	69	214
X–1612	Carnegie	557	72	214

* The medium contained 4 per cent corn steep liquor (dry basis), 3 per cent lactose, and 1 per cent calcium carbonate.

† Because the yield on the reference cultures varied, the yield on the culture tested should be compared with the reference culture yield given in this column, which was determined at the same period under the same conditions.

‡ No calcium carbonate was used. The medium was adjusted to pH 6.5 with NaOH.

In Table 1 are listed the highest yields obtain with each of the cultures tested in tanks. Highe yields on two cultures obtained from the Northe Regional Research Laboratory of the U. S. Depar ment of Agriculture are included for comparis since these have been widely used and may be r garded as reference cultures. The last column of t table gives yields obtained on one of the referen cultures under conditions comparable with those und which the new culture was tested. This column included because of the presence of a substant degree of uncontrolled variability, due to changes the composition of the corn steep liquor used and unknown factors.

As may be seen from the table, only one of the ne cultures, No. X–1612, gave a yield greatly in exce of that obtained with culture No. 1951–B25. Cultu

TABLE 2

EFFECT OF NUTRIENT LEVEL ON YIELD OF CULTURE X-1612*

Composition of medium				Yield	Age at maximum yield
Corn steep liquor (solids)	Lactose	$CaCO_3$	Salts†		
Per cent	Per cent	Per cent		Units/ml.	Hours
2	2	0.2	+	239	54
4	3	1	–	480	64
6	3	1	–	636	67

* The fermentation conditions were those described in Table 1.

† The salts added per liter of medium were 0.25 gram KH_2PO_4, 0.12 gram $MgSO_4 \cdot 7H_2O$, and 1.5 gram $NaNO_3$. At a low steep liquor concentration the use of an auxiliary nitrogen source is desirable.

X–1612 is an X-ray mutant from *Penicillium chrysogenum* culture No. 1951–B25 of the Northern Regional Research Laboratory. This X-ray mutant was produced at the Carnegie Institution and after preliminary tests was forwarded for further testing to the University of Minnesota, where its performance in shaken flask cultures resulted in its being included with a group of promising Minnesota cultures forwarded to the University of Wisconsin for larger-scale tests.

The penicillin yield obtained with this culture is, of course, greatly influenced by the conditions of nutrition, aeration, and agitation under which it is grown. Illustrative data on the effect of nutrient level at a high aeration rate are given in Table 2. It will be noted that in the presence of excess lactose (unfermented sugar remained at the end of each of the

mentations) the penicillin yield is a function of corn steep liquor level used.

Addendum: It is regretted that publication delay caused this preliminary report to lose some of its significance during the interval since the manuscript was submitted on 30 July 1945. Since that time a number of papers describing work in which Culture 1612 was used have appeared in this journal and elsewhere, from this and from other laboratories.

The Evolution of Oxygen From Illuminated Suspensions of Frozen, Dried, and Homogenized Chloroplasts

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M. L. ANSON
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The evolution of oxygen from suspensions of chloroplasts in solutions containing ferric oxalate and potassium ferricyanide was discovered by Hill and Scarisbrick (*5*). The possible relation of this photochemical and enzymatic reaction to the process of oxygen evolution by green-leaf photosynthesis and further details of the reaction have been discussed by various authors (*1, 2, 3, 4, 6, 7, 8*). It is the purpose of this note to summarize some data on the activity of chloroplast preparations that have been treated in various ways.

The significance of this work lies in the fact that chloroplast preparations are shown to be amenable to some treatments, such as would be necessary for the separation of their active components. By the use of similar preparations it may be possible to study some of the enzymes involved in a reaction which is initiated by light absorbed by chlorophyll and which results in oxygen evolution.

The participation of an enzyme system in the reaction appears to be indicated from the thermolability of the preparation and also from the inhibition by low concentrations of enzyme poisons such as NH_2OH, Duponol, NaF, and NaN_3. The Hill reaction is considerably less sensitive to NaN_3 than is the catalytic decomposition of H_2O_2 by chloroplasts.

Concomitant with the oxygen evolution there is also a production of H^+ which affords a simple means of measuring the reaction velocity. We have used a constant pH titration procedure for many of the activity measurements. In order to obtain quantitative results it is necessary to use a red filter to prevent the effects of light on the reagents themselves at high light intensity. The pH optimum was found to be at pH 7.0 or 7.5, depending on the conditions of measurement. Higher rates and a greater total evolution of oxygen were found if nitrogen was used instead of air in the manometer vessels. Temperatures of about 10° are most suitable for the measurement of this reaction, since the activity is rapidly lost at room temperature. Chloroplasts suspended in solutions of potassium ferricyanide alone were found to produce oxygen when illuminated, but at a lower rate than when ferric oxalate was also present. Supersonic irradiation breaks up the chloroplasts to give solutions which, when centrifuged for ¾ hour at *ca.* 20,000*g*, are green and appear clear but show the Tyndall scattering effect in an intense beam of light. The effects of various treatments on the activity of preparations of chloroplasts in ferric oxalate solution with ferricyanide are shown in Table 1.

TABLE 1

THE INFLUENCE OF VARIOUS TREATMENTS ON THE PHOTOCHEMICAL O_2 EVOLUTION BY CHLOROPLASTS IN A SOLUTION CONTAINING FERRIC OXALATE AND POTASSIUM FERRICYANIDE

Original material	Treatment	Per cent of original activity retained after treatment
Suspension of intact chloroplasts in 0.5 M sucrose	Frozen 15 hr.	72
"	Disintegrated in blender	54
Suspension of intact chloroplasts washed with water	Lyophilized	69, 31
"	Dried with molten $Na_2SO_4 \cdot 10 H_2O$	78, 69
Suspension of intact chloroplasts in 0.5 M sucrose	Supersonic 1 min.	118
"	Supersonic 1 min. followed by ½ hr. centrifugation at 800*g*. Supernatant used after 15 hr. at 0°	81
Suspension of chloroplasts in water	Supersonic 1 min., centrifuged at 20,000*g* for ½ hr. Supernatant green solution used.	134
"	Sediment from the above centrifugation.	0
Fragments of leaves after 5 min. in blender strained, collected by centrifugation for ½ hr. at *ca.* 20,000*g*	Washed by suspension in water, recentrifuged, precipitate used.	57
	Above plus boiled water extract of leaves.	100
	Precipitated with ⅓ saturation $(NH_4)_2SO_4$	94, 83, 54, 55, 67

From these data it is seen that freezing, drying, thorough disintegration of the chloroplasts, or precipitation by ammonium sulfate results in preparations that still retain considerable activity. In conclusion, we may say that these experiments show that the ability to produce oxygen is a property not only of intact chloroplasts but also of material which has been exposed to some of the conditions that would be necessary in attempts to fractionate the enzymes involved in the reaction by which oxygen is produced.

Addendum: The papers of Warburg and Lüttgens (*9*), announcing the discovery of a similar reaction of chloroplasts which form oxygen and hydroquinone with an energy uptake of 52,000 calories, supplied by light, have recently become available to us. The quinone reaction appears even more promising than the one here described as a means of investigating the mechanism of photosynthetic oxygen evolution in green plants.

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Association Affairs

The One Hundred Twelfth Meeting of the American Association for the Advancement of Science

F. R. Moulton
Permanent Secretary, AAAS, Washington, D.C.

THE ONE HUNDRED TWELFTH MEETING of the American Association for the Advancement of Science was held in St. Louis, Missouri, 27–31 March 1946, inclusive. At this meeting, the fifth held in St. Louis, a completely revised constitution of the Association was formally adopted by the Council. The preceding constitution of the Association was adopted at the third St. Louis meeting, held in December of 1919.

Never before has the Association held an annual meeting under such trying conditions. The prohibition on the holding of meetings by the Office of Defense Transportation was removed so late in the year that only three months were available for preparations for the St. Louis meeting. An obvious suggestion would be that it should have been held later or in some other city. The answers to this suggestion are that there was no other city which would undertake to provide even limited accommodations for such a large meeting and that there were no other four consecutive days in which some other convention had not been scheduled for St. Louis. Since only one meeting of the Association had been held in the preceding four years, and since the next available time for a meeting would be a year later (in December 1946), it was decided to proceed with plans in spite of difficulties.

The St. Louis meeting was not a simple convention but a joint meeting of 41 independent societies and 13 sections of the Association. All meeting arrangements for these 54 organizations, including rooms and facilities for 229 sessions, were made by the staff of the Association. In order to provide accommodations for them it was necessary to have 58 different meeting rooms, many of which had to be equipped with projection apparatus. At times as many as 40 sessions were held simultaneously, necessitating the use of practically all suitable meeting rooms throughout the city. The most difficult problem, however, was that of providing living accommodations for those attending the meeting. The St. Louis Convention and Publicity Bureau gave the Association unfailing cooperation and assistance in obtaining rooms in all possible places, including hotels, local educational institutions, and private homes. Written appeals for assistance were sent by the Association to its 300 members in St. Louis, and they generously extended it up to the limits of their capacities to accept temporary guests in their homes. Despite these efforts it was

necessary to send notices to several hundred applicants for accommodations that rooms would not be available. The serious shortages in accommodations were indirect consequences of the war and were almost invariably accepted by scientists with the same fortitude exhibited by them in meeting hardships throughout the war.

Registration

A much large number of scientists attended the meeting than was expected under the existing unfavorable conditions, with the result that copies of the General Program were exhausted on the second day, at which time the registration was far from complete. Nevertheless, 2,649 persons from 46 states, the District of Columbia, and 14 foreign countries registered as follows: Alabama, 19; Arkansas, 24; California, 49; Colorado, 22; Connecticut, 37; Delaware, 8; District of Columbia, 53; Florida, 15; Georgia, 23; Illinois, 436; Indiana, 120; Iowa, 111; Kansas, 60; Kentucky, 16; Louisiana, 23; Maine, 6; Maryland, 56; Massachusetts, 48; Michigan, 132; Minnesota, 80; Mississippi, 17; Missouri, 530; Montana, 2; Nebraska, 47; Nevada, 2; New Hampshire, 1; New Jersey, 37; New Mexico, 5; New York, 182; North Carolina, 15; North Dakota, 11; Ohio, 115; Oklahoma, 61; Oregon, 1; Pennsylvania, 65; Rhode Island, 3; South Carolina, 12; South Dakota, 7; Tennessee, 35; Texas, 58; Utah, 6; Vermont, 1: Virginia, 39; Washington, 7; West Virginia, 10; Wisconsin, 100; Wyoming, 5; Argentina, 2; Belgium, 1; Brazil, 1; Canada, 13; China, 1; Cuba, 1; England, 2; Hawaii, 4; India, 3; Mexico, 4; Panama, 1; Puerto Rico, 3; Siam, 1; Venezuela, 1.

The distribution of the registrants proves that the St. Louis meeting was national, and even international to a considerable degree; the general program and the reports which follow show that the papers presented ranged widely over the numerous fields of the natural and the social sciences. After a long dearth of scientific meetings scientists could well afford to endure some inconveniences for such opportunities for conferring with their fellow scientists.

General Sessions

Four general sessions open to the public were held. On Wednesday evening, 27 March, the retiring president of the Association, Dr. Anton J. Carlson, delivered an address before a large and appreciative audience on: "Is There 'a Standard to Which the Wise and the Honest Can Repair?'" Dr. James B. Conant, president of the Association for 1946, presided. Dr. Carlson's address was printed in full in *Science*, 1946, **103**, 377–382.

On Thursday evening, 28 March, the twenty-second Annual Lecture under the joint auspices of the Association and the Society of the Sigma Xi was delivered by Dr. E. C. Stakman, of the University of Minnesota, whose topic was: "Progress and Problems in Controlling Diseases of Crop Plants." This session, of which Dr. Conant was chairman, was well attended and enthusiastically received.

At the third general session, held on Friday evening, 28 March, Dr. Irwin Edman delivered the ninth Annual Lecture sponsored jointly by the Association and the United Chapters of the Phi Beta Kappa. Dr. Edman's address, on "Science and the Dream of Happiness," was listened to with much pleasure by an exceptionally large and distinguished audience. Dr. Arthur H. Compton, a former president of the Association and recently elected chancellor of Washington University, presided at the meeting and introduced Dr. Edman.

The illustrated lecture sponsored jointly by the National Geographic Society and the Association drew an audience that filled to overflowing the large opera house of the Kiel Auditorium. Mr. Luis Marden, staff photographer and writer of the National Geographic Magazine, delivered an address on "Seeing Costa Rica," which was illustrated by colored motion pictures.

Meeting of the Council of the AAAS

Hotel Jefferson, St. Louis, Missouri, 27 March 1946, 2:00 P.M.

Otis W. Caldwell
General Secretary, AAAS

The presiding officer, A. J. Carlson, chairman of the Executive Committee, asked Secretaries Moulton and Meyerhoff to present items of business recommended by the Executive Committee.

1. It was moved by B. E. Livingston that the official year of the AAAS shall be the same as the calendar year. The motion was passed unanimously.
2. It was moved by B. E. Livingston that the Cleve-

land meeting of the AAAS be declared the annual meeting for 1944, and that the St. Louis meeting be declared the 1945 meeting of the AAAS. The motion was passed unanimously.

3. Secretary Meyerhoff reported the recommendation of the Executive Committee that the Revised Constitution in the exact wording as presented at Cleveland, 1944 annual meeting, be presented at the general meeting of the AAAS at the night meeting at St. Louis, 27 March 1946. This report of the Executive Committee does not require action by the Council.

4. The Permanent Secretary's financial report for the year 1945 and proposed budget for 1946 were presented and approval asked. There was discussion by Secretaries Meyerhoff and Moulton. The 1944 financial statement, previously printed, was also discussed.

B. E. Livingston moved and Kirtley Mather seconded that the 1944 financial report be approved. The motion was passed unanimously.

B. E. Livingston moved and Kirtley Mather seconded that the 1945 report be approved and ordered audited and printed. The motion was passed unanimously.

5. Secretary Moulton reported the present status of the building fund, stating that almost $100,000 has been contributed. Secretary Meyerhoff urged cooperation on further contributions.

6. Secretary Moulton reported a Philadelphia proposal regarding a permanent home for the AAAS in Philadelphia. No action was taken.

7. The place of the next meeting was presented. It was moved and seconded that the meeting of December 1946 be held in Boston, Massachusetts. The motion was passed unanimously.

8. Applications for affiliations or association with the AAAS were presented.

a. Society of Economic Geologists—data presented by Secretary Meyerhoff. W. R. Miles moved and Kirtley Mather seconded that it be affiliated. The motion was passed.

b. American Society for Aesthetics—data presented by Secretary Meyerhoff. A motion by the latter, seconded by F. E. E. Germann, recommending its acceptance as an associated society was passed.

c. Academy of World Economics—data presented by Secretary Meyerhoff. Kirtley Mather moved and Otis W. Caldwell seconded that it be affiliated. The motion was passed.

d. Pi Gamma Mu asked change from association to affiliation. A motion to this effect by Secretary Meyerhoff, seconded by Anton J. Carlson, was passed.

e. Beta Beta Beta, Honorary Historical Society—data presented by Secretary Meyerhoff, who moved, Kirtley Mather seconding, that it be affiliated. The motion was passed.

f. Herpetologists League—data presented by Secretary Meyerhoff. Secretary Moulton moved and W. R. Miles seconded that it be associated. The motion was passed.

g. American Society for Professional Geographers. Its affiliation was moved by Kirtley Mather and seconded by Otis W. Caldwell. The motion was passed.

9. Report was made to the Council by Secretary Moulton regarding publication of Proceedings of the AAAS. No Council action was required.

10. The following resolution by Section Q was presented by R. T. Shaw: That the Council of the AAAS authorize and direct the Executive Committee to set up a Legislative Committee whose powers and duties shall be prescribed by the Executive Committee. The number of members, their qualifications, and method of election or appointment shall be prescribed by the Executive Committee, subject to such modification as may be made from time to time by the Council.

It was moved by G. A. Baitsell and seconded by W. Kaempffert that the resolution be tabled, and the motion was lost. Discussion by Secretary Meyerhoff and W. Kaempffert followed. It was thereupon moved by Kirtley Mather and seconded by Dr. Millerton that the resolution be referred to the Executive Committee for study and report to the Council. The motion was passed.

11. It was moved by B. E. Livingston and seconded by Kirtley Mather that in the judgment of the Council the present committee on Science Legislation, which has been functioning for several months, should continue its functions. The motion was passed unanimously.

G. A. Baitsell expressed his opinion that officers of the Society appearing before legislative committees should be careful to make it clear that personal opinions are being expressed, except when their statements are based on a poll of the Council on the full membership.

12. A motion by Kirtley Mather that when the Council adjourns it shall adjourn to meet at 4:00 P.M. on Friday, 29 March 1946, was passed, as was a motion to adjourn.

Minutes of the Adjourned Meeting, 29 March 1946, 4:00 P.M.

The meeting was called to order at 4:15 P.M. by President James B. Conant. Minutes of the Council meeting held on 27 March 1946 were read, corrected, and approved.

1. President Conant reported the action of the Association on the Revised Constitution at the general session of the AAAS, Wednesday evening, 27 March 1946. It was stated to the Association that, in accordance with constitutional provisions and with the approval of the Council, it was proposed that the present Third Constitution of the Association (adopted at St. Louis in 1919) be amended by the ratification of a new Constitution. The proposed new text was published in *Science* on 1 September 1944, and was published again in the same journal on 1 March 1946. Since this same revision received a majority vote at the preceding general session of the Association (Cleveland meeting in 1944), a majority vote of the members present at the St. Louis general session would now ratify the Revised Constitution, and this new Constitution would then become the Fourth Constitution of the Association, effective one month later, *i.e.* on 27 April 1946. It was moved and seconded that the Revised Constitution be adopted.

President Conant called for a vote, reported that the vote was almost unanimous, and declared the Revised Constitution adopted, to be effective as of 27 April 1946.

2. W. R. Miles, who had acted as secretary of the preceding meeting of the Executive Committee, reported recommendations. It was moved by A. H. Compton and seconded by Otis W. Caldwell that the Executive Committee recommend to the Council that it approve the present Kilgore-Magnuson Bill, S. 1850, and that if this recommendation should secure a two-thirds affirmative mail vote of those voting, the Executive Secretary of the Association be thereby authorized to take all steps practical to facilitate the passage of S. 1850 through Congress, and that the president of the Association, Dr. Conant, be authorized to appoint a special committee, of which he is to serve as chairman and Secretary Meyerhoff as a member, which shall endeavor to carry through the intent of this motion.

It was moved by A. J. Carlson and seconded by Kirtley Mather that the above be endorsed and sent by mail ballot to the full Council. The motion was passed.

3. It was moved by A. J. Carlson and seconded by E. C. Stakman that the president of the Association be empowered to enlarge the Committee on Science Legislation by the appointment of three additional members, and that the Committee be instructed to expand its work of collecting and publishing information to include, if possible, all proposed congressional and state legislation affecting science. This motion was passed unanimously.

4. The financial report of the Permanent Secretary was accepted.

5. The resolution from Section Q, referred to in minutes of preceding Council meeting, was read by W. R. Miles. Drs. Martin, Shaw, Carlson, Urey, Mather, Stakman, Compton, and Conant spoke on the motion.

A motion by A. J. Carlson, seconded by E. G. Martin, that the Executive Committee be asked to study the resolution further to determine whether action is desirable, was carried by a vote of 17 in favor and 12 opposed, 9 persons present not voting.

6. Paul Weiss moved that the Council establish a Council in Methodology of Science. Such a group would study the content, objectives, methods, and procedures of science as used in research, education, and applications. It was moved by A. J. Carlson and seconded by W. R. Miles that this proposal be referred to the Executive Committee for further study. The motion was passed.

7. B. E. Livingston presented the following resolution of appreciation of the services given to the meetings of the AAAS by other citizens of St. Louis.

The Council of the American Association for the Advancement of Science is glad to express its appreciative thanks to many institutions of St. Louis and to many people of the city for their helpful cooperation in making the fifth St. Louis meeting of the Association a successful one, despite some difficulties due to postwar conditions. Held from 27 to 30 March, this was the Association's 112th meeting.

The Council appreciates the many facilities made available by the St. Louis Convention and Publicity Bureau, by the hotels of the city, by the St. Louis Academy of Science, and by Washington University and Saint Louis University. Cordial interest in the meeting was shown by the 26 members of the local advisory committee, by many other citizens, and by the general public of St. Louis. The local Press and the representatives of many metropolitan dailies and news syndicates provided amply for wide dissemination of news of this meeting throughout America and the world.

Only the joint efforts of the public, through local organizations and individuals, and of the Association can effectively promote the advancement of science, and the Council welcomes this opportunity gratefully to acknowledge its debt.

Dr. Livingston moved its acceptance, W. R. Miles seconded, and the motion was passed.

8. President Conant, on request by A. H. Compton, briefly discussed proposed control of studies and uses of atomic energy. A general discussion followed.

9. By vote, the Council adjourned at 5:40 P.M.

Sections and Societies

Howard A. Meyerhoff
Executive Secretary, AAAS, Washington, D.C.

Mathematics

Section A, Mathematics, held three sessions, in addition to a luncheon on Saturday. The attendance was about 95.

On Friday afternoon, 29 March, L. M. Blumenthal, University of Missouri, spoke on "Some Metric Peculiarities of Elliptic Space," and J. L. Walsh, Harvard University, delivered his address as retiring vice-president of the Association and chairman of Section A on "Taylor's Series and Approximation to Analytic Functions." R. E. Langer, vice-president and chairman elect of Section A, presided.

On Saturday morning R. R. Middlemiss, Washington University, the chairman of the Missouri Section of the Mathematical Association of America, presided at a joint session of the Missouri Section and Section A. G. M. Ewing, University of Missouri, spoke on "Problems Arising From the Introduction of High School Mathematics Into the Colleges"; A. E. Ross, Saint Louis University, spoke on "A Course in the Interpretation of Basic Mathematical Concepts for Teachers in Secondary Schools"; and S. E. Warschawski, University of Minnesota, delivered an invited address on "Some Convergence Theorems in Conformal Mapping."

W. H. Roever, Washington University, presided at the Saturday luncheon for mathematicians at the DeSoto Hotel, and Prof. Langer spoke informally on immediate problems of departments of mathematics in the universities.

On Saturday afternoon, G. W. Snedecor, Iowa State College, presided at a joint session of the Institute of Mathematical Statistics and of Section A. Invited addresses were delivered by Cdr. J. H. Curtiss, USNR, on "Statistical Inference and Its Engineering Applications," and by M. H. Hansen, Bureau of the Census, on "Some Sampling Problems in Surveys of Business and Population." (*From reports by R. W. Brink and P. S. Dwyer.*)

Physics

The meeting of Section B, Physics, was held Friday morning, 29 March. About 125 persons attended. During the vice-presidential address the chair was taken by A. L. Hughes, of Washington University, R. C. Gibbs, vice-president of the Association and chairman of Section B, chose as his title "Whither Physics?" and discussed the problems facing physics as a result of the expansion of its activities during the war. Rear Adm. Bowen, USN, chief of the Office of Research and Inventions, spoke on "The Navy in Research," followed by Capt. M. J. Lawrence, USN, on "How the Navy Implements Its Research Program." Two invited papers on the application of physics to biology followed, one by Francis O. Schmitt, of the Massachusetts Institute of Technology, on "X-ray Diffraction and Electron Microscope Studies of Cell Structure," and the other by M. D. Kamen, of Washington University, on "The Use of Radioactive Tracers in Biological Research." (*From a report by Joseph C. Boyce.*)

At the meeting of the American Meteorological Society, six papers were presented: (1) "Storms and the Origin of Microseisms," by James B. Macelwane, S.J.; (2) "Tracking Hurricanes With the Seismograph," by M. H. Gilmore (read by Fr. Macelwane); (3) "The Effect of Varying Pressure Gradients on the Trajectory of Air Parcels," by Lester Machta, Sr.; (4) "A High Altitude Meteorological Research Program," by Lt. Cdr. Daniel F. Rex; (5) "Heavy Snow Situations at Kansas City," by Oscar Tenenbaum; and (6) "Some Theorems of Vorticity and Development," by Lt. N. R. Beers.

The first two papers brought forth convincing evidence that severe cyclones cause an increase in the amplitude of microseisms, and that hurricanes can be mapped from the seismic disturbances resulting from them. This discovery ranks, along with storm location by radar and by aircraft reconnaissance, as the most significant contribution to the tracking of tropical storms since I. M. Cline first realized the importance of storm tides as a means of following their path (1900). The third paper showed that a noticeable error would result from the use of gradient winds in computing air trajectories because of the large magnitudes of the departures from the gradient winds associated with the accelerations of changing pressure gradients. The fourth paper outlined a new method of obtaining meteorological measurements at very high altitudes, from 100,000 to 500,000 feet, by the use of fully equipped rockets. The fifth paper was illustrated with weather maps showing four types of synoptic situations which may produce heavy snowstorms in the vicinity of Kansas City. The final paper treated certain phases of the subject of vorticity from an original theoretical viewpoint and dealt with the validity of some existing theories.

The meeting was fairly well attended, with about 0 people registering. (*From a report by E. M. ooks.*)

Chemistry

No report has been received from the secretary of ction C, Chemistry, but a few brief notes can be epared from material in the office of the Permanent cretary. The feature of the meetings of the section s a symposium on chemotherapy, consisting of eight pers which were presented in four sessions on ursday and Friday, 28–29 March. In order to ovide ample opportunity for discussion of the pers, only two speakers were scheduled in each ssion. R. B. Woodward and S. A. Waksman, in llaboration with A. I. Schatz, were the principal eakers on the Thursday morning program; Walter eger and K. P. Link featured on the Thursday ternoon program, which was followed by a business eeting of the section committee and a dinner, at hich the retiring chairman of the section, Arthur Hill, gave his address. E. A. Doisy acted as honor- y chairman of the dinner and introduced the peaker. On Friday, the symposium on chemotherapy as continued, various aspects of biochemistry being resented by E. A. Evans, W. Price, M. Slein, S. P. olwick, C. F. and G. T. Cori, O. H. Gaebler, and J. J. Williams. The sessions were well attended and ell received.

Astronomy

Section D, Astronomy, met for two sessions, first n the afternoon of Friday, 29 March, and again on he forenoon of Saturday. The program included 7 papers.

The retiring vice-president, Seth B. Nicholson, of the Mount Wilson Observatory, addressed the section on "The Solar Cycle." O. C. Mohler presented the retiring address of Robert R. McMath, of the McMath-Hulbert Observatory, which had been postponed from the Dallas meeting. This address, entitled "Three-dimensional Work on Prominences," was illustrated by motion pictures of solar prominences. The vice-president of the section, J. J. Nassau, of the Case School of Applied Science, presented a paper on "Problems Relating to Objective Prism Spectra," and the vice-president elect, G. Van Biesbroeck, of the Yerkes Observatory, presented a paper on "Nebular Photographs With the 82-inch McDonald Reflector."

A paper which attracted considerable interest was "Possibilities in the Astronomical Use of Radar," presented by W. W. Salisbury, of the Collins Radio Corporation. Other papers touched on the subjects of stellar constitution, eclipsing binaries, the recent nova T Coronae Borealis, the orbits of comets, of Mercury, and of Uranus, celestial navigation, and stone-dropping meteors.

The number attending the Friday afternoon session was estimated at 35, and the number attending the Saturday forenoon session was estimated at 40. To give more time for the section luncheon on Saturday, the papers of absent authors were placed at the end of the program, and a few were merely read by title. The section members were entertained at luncheon by Eugene and Jessica Y. Stephens at their home in Clayton. (*From a report by C. C. Wylie.*)

Geology and Geography

Section E, Geology and Geography, held nine sessions on Wednesday, Thursday, and Friday. Most of the sessions consisted of symposia or of integrated papers on related topics. This method of program construction appeared to be successful and met with general approval. Attendance varied from 35 to 90, with an average of 60 at each session. The estimated number of different persons attending all sessions was 325.

The Section Committee met for dinner and discussion of section policies on Thursday evening, with an attendance of 15 committee members and guests who had had a part in arranging the symposia and facilities for the St. Louis meeting. The sessions had the cooperation of the Geological Society of America, the Association of American Geographers, and the American Institute of Mining and Metallurgical Engineers, Industrial Minerals Division; and the specially printed Section E program, with abstracts, was provided through the cooperation of the Geological Society of America. Carl Tolman was chairman of the local committee for the meetings.

On Wednesday, both morning and afternoon, the section held a symposium on Pennsylvanian, organized by H. R. Wanless. The first part was composed of five summary papers dealing with stratigraphic principles and problems of the Appalachian, Mid-continent, Texas, and New Mexico regions. The second part of the symposium was made up of five papers on Pennsylvanian paleontology, in which modern uses of invertebrates, microfossils, plant fossils, and spores were discussed.

On Thursday morning the section met jointly with the Industrial Minerals Division of the American Institute of Mining and Metallurgical Engineers for a series of papers organized by Richard M. Foose. These papers dealt with various industrial minerals of the central part of the United States. On Thursday afternoon Howard A. Meyerhoff, retiring chairman, presented his vice-presidential address, "Geomorphology—The Inexact Science." The remainder

of the session was given over to six papers, most of which dealt with new discoveries and new conceptions in Appalachian geomorphology.

On Friday morning the section met for concurrent sessions. The first was a symposium on Pleistocene geology, organized by Leland Horberg, in which eight papers were presented on recent Pleistocene discoveries and current problems in the central states. The second session on Friday morning consisted of five papers on general geological topics. At the Friday afternoon session, six papers on Missouri geology were presented in a session organized through the cooperation of E. D. Clark and E. B. Branson.

On Wednesday afternoon Section E joined with Section K in a joint symposium on "The Impact of Technology on Society," and on Thursday morning with Sections O and K in a symposium on "Relations of Soils to Plant, Animal, and Human Nutrition." [See reports of Sections O and K.] (*From a report by G. W. White.*)

Zoology

The formal programs of Section F, Zoology, were held under the sponsorship of the American Society of Zoologists.

At the business meeting of Section F it was resolved that after 1 January 1948 the Executive Committee of the Section Committee should consist of the elected secretaries of the following affiliated societies: Entomological Society of America, American Society of Zoologists, American Association of Economic Entomologists, American Society of Naturalists, Ecological Society of America, Genetics Society of America, American Microscopic Society, Limnological Society of America, and American Society of Parasitology.

The chairman and secretary of Section F continue as ex officio members of the Executive Committee. It was further resolved that the members elected to the Committee should take office 1 January 1947 and should serve one year only and that the other members whose terms extend beyond 1 January 1948 should continue to serve their term.

The greatest interest aroused in the section was the definite formulation of plans to organize an American Institute of Biology. (*From a report by J. W. Buchanan.*)

At the 20th annual meeting of the American Society of Parasitologists 69 papers were presented either in person, by demonstration, or by title. The address of the retiring president, A. C. Chandler, "The Making of a Parasitologist," was delivered at the end of the morning session of the second day. This event was followed by the annual luncheon and the general business meeting of the Society. The afternoon of the second day was devoted to a demonstration p gram and a hospitality session. All the program s sions were well attended. One hundred and twen one persons were present for the luncheon and b ness meeting.

At the business meeting, the following persons w elected to the Society offices: president for 1946, N. Stoll, Rockefeller Institute, Princeton, New Jers vice-president for 1946, H. Kirby, Jr., University California; secretary for 1946–1947, J. T. Culbertso Columbia University; and councilors-at-large thro 1949, W. T. M. Cameron, of McGill University, a W. H. Wright, of National Institute of Health.

The Society formally endorsed the formation of organization of biologists on the basis of the two f lowing propositions submitted by the representati to the Council of the Union of American Biologi Societies: (1) to provide a means for executing public responsibilities as biologists and scientists, that the freedom essential to the progress of scien and public welfare be ensured; (2) to safeguard professional interests of biologists and to assist providing the material means for the promotion biological research; also to provide such services may be necessary to facilitate this program. (*Fr a report by J. T. Culbertson.*)

The 42nd annual meeting of the American Soci of Zoologists was held on 28–30 March in conjuncti with Section F, AAAS, and in association with s eral other biological societies.

One symposium was arranged by President A. Pearse with the cooperation of Thomas Park. Th dealt with a review of the problem of dynamics production in aquatic populations. The participan presented a critical review of recent work with respe to certain marine and fresh-water populations. feature of particular interest was the discussio period which followed the formal presentation papers.

Although the number of papers read in person w not as large as in the years immediately preceding the war, the number compared favorably with thos presented at meetings in the early 1930's. In all, 8 papers were read, and there were also 16 demonstra tion papers and 105 papers presented by title.

Six regular sessions for the reading of papers wer held, in addition to the symposium and a single after noon demonstration session.

Approximately 350 persons attended the regular sessions of the Society. The annual dinner was held on Friday evening with 280 persons attending. Ca G. Hartman, retiring chairman of Section F, gave th dinner address on "The Little Researcher."

At the annual business meeting, held on Friday

March, the following officers were elected for the 1946: D. E. Minnich, University of Minnesota, ident; E. G. Butler, Princeton University, vice-ident; L. V. Domm, University of Chicago, secre-; and A. S. Pearse, Duke University, member of Executive Committee. (*From a report by L. V. mm.*)

t a joint meeting of the North Central States nch of the American Association of Economic omologists and the Entomological Society of erica, 27–29 March, the entomologists discussed in e detail their relationship with the National Sci- Foundation. A committee was appointed to pre- a resolution for the support of legislation now ding in Congress. A resolution was later adopted forwarded to the proper authorities.

The recent developments in machinery for the plication of insecticides and fungicides were re- wed by the conference. Particular attention was voted to the airplane as a modern means of the ge-scale application of chemicals to field and forest eas.

The use of DDT in agriculture for the control of ny kinds of insects entered into all of the ento- logical programs. P. N. Annand, chief of the reau of Entomology and Plant Quarantine, Wash- gton, D. C., presented a most excellent summary of DT as it may now be applied against insects attack- g agricultural crops. A series of half-day con- rences were held on the control of insects attacking ld, garden, fruit, livestock, greenhouse, and forest ops. The chemistry and toxicology of the several w chemicals applied against insects were reviewed. total of 187 entomologists registered for the con- rence. (*From a report by M. D. Farrar.*)

The 40th annual meeting of the Entomological So- ety of America was held at the same time as the eetings of the North Central States Branch of the AAEE. About 200 entomologists from the two so- ieties were in attendance. The program included hree sessions at which papers were presented, cover- ng a wide scope of entomological research. A joint ession was held Thursday morning with the North Central States Branch, at which several important matters of national character, bearing on entomology, were discussed. Friday morning the Entomological Society had a very interesting joint session with the Ecological Society of America. The entomologists' banquet was held on Thursday evening. After the banquet James A. G. Rehn, president of the Ento- mological Society, gave the presidential address, "En- tomology as an Integrant Part of Zoological Science."

The business meeting was held Thursday afternoon. Officers for the coming year are: president, C. F. W. Muesebeck; 1st vice-president, S. A. Graham; 2nd vice-president, Alvah Peterson; and secretary-treasurer, Herbert H. Ross.

A high light of the meeting was the participation of a large group of entomologists until recently in the armed services. Many had been discharged only in the last two or three months, and many contributed interesting papers based on their experiences in various parts of the world with unusual aspects of medical entomology. (*From a report by H. H. Ross.*)

Botany

Section G, Botanical Sciences, met in joint session with the Botanical Society of America, the American Phytopathological Society, the American Society of Plant Physiologists, the American Society of Plant Taxonomists, the Mycological Society of America, and the Sullivant Moss Society. The program consisted of the retiring address of the chairman of the section and president of the Mycological Society of America, Frank D. Kern, on "Some Bases for Mycological Progress." This address was followed by a paper by John T. Buchholz, vice-president for the section for 1942, on "Evolutionary Role of Embryonic Selection in Pines," and by an invitation address by E. B. Babcock on "New Light on Evolution From Research on the Genus *Crepis*." The total attendance was about 250. (*From a report by G. W. Martin.*)

The 37th annual meeting of the American Phytopathological Society held in St. Louis on 27–30 March was attended by approximately 325 members. Eighty-three papers on original research on plant diseases were presented in nine sectional meetings. Eleven papers were presented on fungicides; 10 on small grain diseases; 13 on virus diseases; 10 on vegetable diseases; 9 on physiology of pathogenic fungi; 10 on cereal diseases and pathogens; 9 on factors affecting disease resistance; 5 on forest pathology; and 6 on disease resistance and genetics. Three papers were presented in the joint session with the American Mycological Society and the American Botanical Society. Joint meetings also were held with the Potato Association of America and with Section G.

The following conferences were held: Plant Disease Survey, in which the question, "How Can We Improve Our Crop Disease Service?", was discussed; Fungicides, where newer chemical pesticides were considered; Extension; Late Blight of Potato; and Tobacco Research Council.

The annual dinner, held on Thursday evening, was attended by 220 members and guests. The officers for 1946, announced at the annual dinner, are: president, J. H. Craigie; vice-president, A. J. Riker; secretary, E. M. Johnson; treasurer and business manager

of *Phytopathology,* R. M. Caldwell; editor-in-chief *Phytopathology,* Helen Hart; councilors, C. H. Arndt, R. W. Goss, R. J. Haskell, H. B. Humphrey, L. D. Leach, M. C. Richards, and C. M. Tucker. (*From a report by E. M. Johnson.*)

The American Society of Plant Physiologists, under the presidency of Paul J. Kramer, Duke University, held six joint sessions with the Physiological Section of the Botanical Society of America; met with Section G on Thursday afternoon; and met with the Physiological Section of the American Society for Horticultural Science and Section O, AAAS, for a symposium on "Mineral Nutrition of Plants and Animals" on Friday afternoon. Attendance was high, averaging 50–75 persons at the six general sessions and 300–400 at the Friday afternoon symposium. A total of 82 papers was presented, with groups of papers or entire sessions on photosynthesis and plant pigments, hormones as growth factors or as herbicides, mineral nutrition, methods, correlation, reproduction, and respiration.

The plant physiologists' dinner was held Friday evening at the Mark Twain Hotel. The election of Dennis Robert Hoagland, University of California, as Charles Reid Barnes Life Member was announced. B. S. Meyer, of Ohio State University, gave the presidential address for 1944, speaking on "The Case for Greater Cooperation Among Science Societies." H. A. Spoehr, Carnegie Institution, retiring president, discussed "The Coming of Age of the American Society of Plant Physiologists," in recognition of the 21st anniversary of the founding of the Society. (*From a report by W. E. Loomis.*)

The Systematic Section of the Botanical Society of America and the American Society of Plant Taxonomists on Thursday and Friday mornings held joint meetings, at which were given a total of 18 papers covering a wide range of topics, most of them illustrated with lantern slides. On Thursday afternoon these two groups met jointly with Section G, AAAS. A memorable occasion was the Friday evening dinner sponsored by the Plant Taxonomists, but attended equally well by members of the Systematic Section. At this dinner Francis W. Pennell delivered the principal address. Saturday morning was reserved for a joint session with the Paleobotanical Section. This session was a symposium, on the general theme "Paleobotanical Taxonomy." The attendance at all of the meetings was very satisfactory, running mostly from 40 to 60. (*From a report by E. E. Sherff.*)

The Botanical Society of America, Inc., held its annual meeting in conjunction with the AAAS and its affiliated societies at St. Louis, 27–30 March, with approximately 560 of its members present. In addition to the daily programs of invitation papers, contributed papers, and symposia presented by the four sections of the Society, joint meetings were held with the American Society of Plant Physiologists, Mycological Society of America, American Society of Plant Taxonomists, Ecological Society of America, American Society for Horticultural Science, and the American Society of Naturalists. The Society also joined the other plant science societies in a joint meeting of Section G on Thursday afternoon. The Southeastern Section of the Society held its annual luncheon on Thursday noon, and the Botanists' Dinner was held on Thursday evening with 367 members present.

A new section of the Society, the Microbiological Section, was organized on Friday afternoon, after which a program of papers on microbiology was presented.

The following officers of the Society were elected and appointed for 1946: Neil E. Stevens, University of Illinois, president; Walter F. Loehwing, State University of Iowa, vice-president; John S. Karling, Columbia University, secretary; George S. Avery, Jr., Brooklyn Botanic Garden, treasurer; Bernard S. Meyer, Ohio State University, editor-in-chief, *American Journal of Botany*; and John T. Buchholz, University of Illinois, member of the editorial board. (*From a report by J. S. Karling.*)

The Mycological Society of America held its 12th annual meeting in St. Louis. The following panel of officers was installed: George B. Cummins, president; John A. Stevenson, vice-president; F. K. Sparrow, secretary-treasurer; Julian H. Miller, George W. Martin, S. M. Zeller, and Frank D. Kern, councilors.

Edith K. Cash and S. M. Pady were appointed to the editorial board of *Mycologia.*

A business session was held Thursday morning, after which there was a program largely concerned with the higher fungi.

The presidential address by the retiring president, F. D. Kern, entitled "Some Bases for Mycological Progress," was also given as the address of retiring vice-president for Section G.

Friday morning's program was concerned with papers on antibiotic substances, fungi parasitic on man, cytology, and Phycomycetes. The afternoon session was devoted to fungi and the war. Papers on textile deterioration, soil burial tests, and fungus damage to battleship equipment were given. In the evening the Society was entertained by Anheuser-Busch, Inc., at a buffet supper, after which papers were heard on the breeding of yeasts and on industrial fermentation with the filamentous fungi.

Saturday morning's session was a joint one with

the American Phytopathological Society and Botanical Society. Papers were given on disease-producing fungi, cytology, inheritance of pathogenicity, and nutrient and cultural requirements of parasitic fungi. (*From a report by F. K. Sparrow.*)

The American Microscopical Society held its Executive Committee meeting Thursday noon. There was a large representation of the entire executive group, which included five past presidents of the Society. Among the subjects discussed were means of meeting the increased costs of publication of the *Transactions* due to increased rates and the return to normal volume. Slight increases in subscription rates and membership dues were agreed upon, as was also the establishment of sustaining and institutional memberships. Favorable responses were given to support of a national Scientific Research Foundation and to the organization of an Institute of Biology.

The annual meeting, held on 29 March, was called to order by the president, Raymond C. Osburn. Favorable reports from the treasurer, A. M. Chickering, and from the acting custodian of the Spencer-Tolles Endowment Fund, Lyell J. Thomas, were received. A necrology of seven members was announced. Six of the deceased members had held membership for more than 55 years. The list included Edward Bausch, a member since 1879; Simon H. Gage, 1882; William Bausch, 1888; Edward Pennock, 1879; Frank Patrick, 1891; William Carl Gower, 1939; and Henry B. Ward, 1887.

Various items recommended by the Executive Committee were adopted by the Society, which voted to meet with the AAAS in Boston next December. Officers elected for 1946 were: president, J. E. Ackert; first vice-president, William Procter; second vice-president, O. W. Richard; secretary, F. E. Eggleton; acting custodian of the Spencer-Tolles Fund, L. J. Thomas; member of the Spencer-Tolles Committee, L. E. Noland; and elective member of the Executive Committee, R. C. Osburn. (*From a report by J. E. Ackert.*)

The American Society of Naturalists sponsored the annual Biologists' Smoker, which was held in the Grand Lounge, Municipal Auditorium, on Thursday evening, 28 March, at 9:00 P.M. An estimated 1,000 persons were in attendance. On Saturday afternoon, 30 March, the annual symposium was held on "Recent Advances in the Dynamics of Behavior." The following addresses were scheduled: "Functional Plan of Organization of the Nervous System," R. Lorente de Nó; "Chemical Kinetics in Relation to Aspects of Behavior," Hudson Hoagland; "Biology of Drives," Curt P. Richter; and "Modern Dynamic Psychology," Carney Landis. The symposium, which was attended by approximately 300 persons, was arranged by Karl S. Lashley. Following the symposium, the retiring president of the Society, E. W. Sinnott, delivered his presidential address on "Substance or System, the Riddle of Morphogenesis." The annual Naturalists' Dinner was omitted this year. At the annual business meeting, C. W. Metz was elected president, and H. A. Spoehr, vice-president. (*From a report by R. E. Cleland.*)

The Beta Beta Beta Biological Fraternity held its regular meeting following a luncheon at the DeSoto Hotel on Thursday. The feature of its program was an address by Wyman R. Green on the life and work of Clarence E. McClung, who was president of Beta Beta Beta at the time of his death. In the business session following the program, plans were made for continuing various phases of activity sponsored by the general society: publication of *Bios*; the undergraduate competition in thesis writing; the McClung Award for undergraduate research; publication of the classroom and vocational guidance series of *Booklets*; and the holding of regional conferences.

New chapters were granted to petitioning groups at Drake University, Texas State College for Women, and Huntingdon College. Officers elected for the ensuing biennium were: Lloyd M. Bertholf, president; F. G. Brooks, secretary-treasurer; Earl Bowen, P. H. Yancey, H. J. Eigenbrodt, A. V. Hunninan, and E. R. Noble, regional vice-presidents. (*From a report by F. G. Brooks.*)

The Ecological Society of America held its 30th annual meeting from Wednesday to Saturday. There were nine sessions, at which 68 speakers presented papers. Total attendance was about 150.

On Thursday afternoon there was a joint symposium with the American Society of Zoologists and the Limnological Society of America on "Aquatic Populations." This event included the following speakers: Thomas Park, University of Chicago; George L. Clarke, Harvard University and Woods Hole Oceanographic Institution; Robert W. Pennak, University of Colorado; W. T. Edmondson, Woods Hole Oceanographic Institution; and W. E. Ricker, Indiana University.

Joint sessions were held with the Entomological Society of America and the Botanical Society of America. Highlights of the strictly intrasociety sessions were the one on applied ecology, John M. Aikman, Iowa State College, chairman; and that on the teaching clinic, Paul B. Sears, Oberlin College, chairman. A very satisfactory ecologists' dinner was held on Friday evening, followed by an illustrated address

by the past president, Robert F. Griggs, George Washington University, entitled: "Timberlines of North America."

Officers for 1946 are: John M. Aikman, Iowa State College, president; Aldo Leopold, University of Wisconsin, vice-president; William A. Dreyer, University of Cincinnati, secretary; and Henry J. Oosting, Duke University, treasurer. (*From a report by W. A. Dreyer.*)

The Genetics Society of America held its meetings on 28–30 March. Demonstration papers were presented at Washington University on the morning of 28 March, with 19 investigators demonstrating either living material or prepared slides and specimens.

The annual luncheon and business meeting was held in Macmillan Hall on the campus at noon, with 141 members present. In the absence of the other officers, the secretary presided. Since the journal *Genetics* no longer needs financial support from the Society, the dues for 1947 were reduced to $1.50. Members are urged, however, to subscribe to *Genetics*. A report was presented by Dr. Muller on the aid of geneticists in wartorn countries. Dr. Metz spoke in support of the Institute of Biology to be formed during the meetings, and a motion for support was carried unanimously. Dr. Demerec reported that the next International Genetics Congress would probably be held in Denmark and Sweden in 1948.

The remainder of the meetings were held in Hotel Lennox. On Thursday and Friday afternoons a total of 25 short papers was presented. Friday morning the Society held a joint session with the American Statistical Association, at which time a symposium was presented on "Statistical Analysis of Hybrid Vigor." On Saturday morning five invitational papers were presented on various timely phases of genetic research. Saturday afternoon was given over to a joint session with the American Society of Naturalists, where a symposium on "Neurodynamics of Behavior" was presented.

The average attendance at the sessions of the Society was about 150. (*From a report by L. H. Snyder.*)

At the eighth annual meeting of the Limnological Society of America Paul S. Welch, of the University of Michigan, was elected president. Prof. Welch has served the Society as secretary-treasurer since its founding in 1935. A. D. Hasler, of the University of Wisconsin, succeeded A. H. Wiebe, of the Tennessee Valley Authority, as vice-president. G. L. Clarke, of Harvard University and the Woods Hole Oceanographic Institution, the retiring president, was elected secretary-treasurer.

The first session of the eighth annual meeting of the Society was held jointly with the American Society of Zoologists and the Ecological Society of America on Thursday afternoon, 28 March. The meeting consisted of a symposium on the "Dynamics of Production in Aquatic Populations." The meeting of the Society was continued on Friday with morning and afternoon sessions, at which 15 papers were presented. Between 50 and 100 members of the Society attended these sessions and remained for the business meeting which followed the afternoon session. (*From a report by G. L. Clarke.*)

The National Association of Biology Teachers, meeting with the AAAS in St. Louis, had an excellent experience as an organization. Members took advantage of the many other biological meetings, made new contacts, attended important sessions of ecology, embryology, genetics, physiology, parasitology, pathology, and others.

The NABT conducted its meetings Friday and Saturday, 29–30 March, at the DeSoto Hotel. Under the leadership of its president, Prevo L. Whitaker, Indiana University, Friday was devoted to the business session.

The program on Saturday was in charge of E. Lawrence Palmer, Cornell University, and the sessions were concluded Saturday evening by a banquet attended by 121 members and guests. The speaker was Otis W. Caldwell, general secretary, AAAS, who discussed the subject: "Of What Does Good Biology Teaching Consist?" (*From a report by H. P. K. Agersborg.*)

On the evening of 28 March, at St. Louis, about 150 biologists attended an open meeting sponsored jointly by the Union of American Biological Societies, the American Biological Society, and the American Society of Naturalists, to consider the establishment of an Institute of Biology to represent and support the interests of American biologists. Robert Chambers, president of the Union of American Biological Societies, presided. The principal speaker was Detlev Bronk. Dr. Bronk pointed out the numerous advantages which biologists would gain by having an Institute, and then outlined some tentative plans for such an organization based largely upon the results of an informal meeting of a few biologists of Cleveland, Ohio, in September 1944. Following some general discussion of Dr. Bronk's address, it was unanimously voted to have the original Cleveland group form the nucleus of a committee authorized to proceed with the development of an American Institute of Biology. This committee was authorized to invite to work with it any other sincerely interested biologists who cared to contribute the necessary time and

energy. The original informal Cleveland committee consisted of the following: Detlev Bronk, University of Pennsylvania, chairman; F. A. Brown, Jr., Northwestern University, secretary; E. G. Butler, Princeton University; Robert Chambers, New York University; A. J. Carlson, University of Chicago; R. E. Cleland, University of Indiana; B. M. Duggar, University of Wisconsin; R. C. Smith, Kansas State College; H. B. Steinbach, Washington University; C. V. Taylor, Stanford University; and Paul Weiss, University of Chicago.

The Society for the Study of Evolution was formally organized in St. Louis on 30 March 1946. The newly elected officers are: George G. Simpson, president; E. B. Babcock, J. T. Patterson, and A. E. Emerson, vice-presidents; Ernst Mayr, secretary; K. P. Schmidt, treasurer; E. R. Dunn, H. J. Muller, Sewall Wright, G. Jepsen, Th. Dobzhansky, and R. Chaney, members of the Council. The Society is an outgrowth of the Society for the Study of Speciation and of the National Research Committee on Common Problems of Genetics, Paleontology, and Systematics. The Society is open to all individuals interested in the dynamics of evolution. Attendance at the organization meeting was about 70 persons. Dues for 1946 were set at $1.00. Contributions for the establishment of a journal will be welcome. It is planned to hold the next meeting with the AAAS in Boston after Christmas 1946. Communications should be addressed to Ernst Mayr, Secretary, American Museum of Natural History, Central Park West at 79th Street, New York 24, New York. (*From a report by A. E. Emerson.*)

Psychology

Section I, Psychology, met jointly with the Midwestern Psychological Association on Thursday, Friday, and Saturday. Although there was no separate registration of the Midwestern group, it was estimated that approximately 200 members attended the sessions. Fifty new members were elected, making a total roster of some 550 people. This was the first meeting of the Midwestern Psychological Association since 1942. Altogether 43 papers were read. Sessions dealt with general psychology, abnormal psychology, comparative psychology, social psychology, and child psychology.

At a joint session of Sections I and Q and the Midwestern Psychological Association, the vice-presidential addresses for those three organizations were given. The speakers were Sidney L. Pressey for the Midwestern Psychological Association, who spoke on "Acceleration: Disgrace or Challenge?"; Florence L. Goodenough, the retiring vice-president of Section I, who spoke on "Semantic Choice and Personality Structure"; while H. H. Remmers, retiring vice-president of Section Q, spoke on "You *Can* Change Human Nature."

The Midwestern Psychological Association announced that its new officers are: Dael Wolfle, president; Claude Buxton, secretary-treasurer; and Fred McKinney, council member. Sidney L. Pressey, the retiring president of the Midwestern Psychological Association, was elected vice-president of the AAAS and chairman of Section I. (*From a report by Harold E. Burtt.*)

The Society for Research in Child Development, in addition to the regular meeting, held informal meetings of officers on Thursday evening, 28 March, and at a luncheon on Friday, 29 March. The Governing Council approved a list of applications for membership in the Society, discussed the advisability of holding a general meeting in the near future, considered necessary business, and laid plans for the agenda of the business meeting.

The first session of the general meeting on 29 March included reports of current research at Antioch College, the University of Illinois, the University of Iowa, and the University of Minnesota.

The second session was a round-table discussion of plans and policies in the postwar world. The main topics discussed were: (1) the problems of obtaining funds and of securing trained personnel to carry on research in child development; (2) the possibility of the Society for Research in Child Development and the Committee on Child Development of the National Research Council forming a nucleus to coordinate research in the child field, or (3) a revolving coordinating committee of experts from the Society to take on the project; (4) the appointment of an outstanding person to carry out and direct a planned project; and (5) the question of individual *vs.* group research, etc.

The third and final session was the business meeting of the Society. In addition to regular business, the following major items were approved: (1) change in election procedure; (2) change of name of the head of the Society for Research in Child Development from chairman to president, this change being made in order to conform to the policy of other societies; and (3) the publication of a popular book for parents.

There was great enthusiasm for future work in child development, and an interest by members and nonmembers alike in the work of the Committee on Child Development and the Society for Research in Child Development. The feeling was general and genuine that it was advantageous to meet with the AAAS for the reason that it was possible to attend sessions of the Association of interest to an interdis-

ciplinary group such as the Society for Research in Child Development. Formal resolutions were prepared expressing thanks to the Association for the excellent arrangements made for hotel accommodations and for the meeting. (*From a report by Beulah Brewer.*)

Social and Economic Sciences

Section K, in partial cooperation with Pi Gamma Mu and Section E, held six program meetings built around the central theme, "The Impact of Technology on Society." In cooperation with the American Library Association, it sponsored an exhibit of books, "The Social Impact of Science," representing holdings of St. Louis libraries and based upon a bibliography prepared by the Library of Congress for the Kilgore Committee.

Programs covered the fields of Planning, Economic Organization, International Relations, Regional Study, Religion, and Human Conservation. A portion of the papers are to be published in *Social Science,* official organ of Pi Gamma Mu, the National Social Science Honor Society.

A business session was devoted to discussion of the function of Section K in relation to other sections of the AAAS and to various national social science organizations. It was decided that Section K should serve as a liaison agent to correlate the interests of such groups.

The papers and discussions emphasized several important relationships between the social sciences and technological change: (1) Technological change is both a result and a cause of social change. (2) It is possible to predict and to plan for technological change. (3) Social research and planning are needed to add meaning to scientific progress in terms of human values. (*From a report by Paul Howard.*)

For the first time in over 25 years of association with the AAAS as an affiliated society, the American Statistical Association and its Biometrics Section arranged a major program for the AAAS meeting. This program consisted of seven sessions. Three of the sessions were symposia of a rather general character, while four dealt with applications of statistical methods to various agricultural and biological problems.

The first of the general symposia was on "Quality Control in American Industry," in which the development of industrial quality control during recent years was discussed. Participants included: F. J. Halton, Jr., Deere and Company, chairman; A. I. Peterson, Radio Corporation of America; J. S. Tawresey, Bunting Bronze and Brass Company; Cdr. E. W. Cannon, Navy Bureau of Ships; and B. L. Clark, Merck and Company. The second general symposium was on "Social Sampling and the Measurement of Opinion." This discussion dealt with the rapidly growing field of opinion polls and surveys and their social, political, and economic applications. Among the participants were: W. F. Ogburn, University of Chicago; S. A. Stouffer, Harvard University; and S. S. Wilks, Princeton University. At the third symposium, devoted to "Personnel Selection by Psychological Tests," personnel selection procedures were discussed with special reference to those used in the Army and Navy during the war. Participants included: P. J. Rulon, Harvard University, presiding; Henry Chauncey, College Entrance Examination Board; Col. John C. Flanagan, Army Air Forces; Cdr. E. L. Kelley, Office of Research and Inventions of the Navy; and M. W. Richardson, U. S. Civil Service Commission.

Of the four sessions arranged by the Biometrics Section, one was devoted to statistical problems relating to studies of hybrid vigor and was held jointly with the Genetics Society of America; another consisted of papers on statistical problems in horticultural research and was a joint session with the Horticultural Society; and the other two were concerned with statistical methodology of various experimental designs in agricultural and biological research. Approximately 15 papers were read in these four sessions. Participants in the sessions included: J. W. Gowen, Paul G. Homeyer, and G. W. Snedecor, Iowa State College; R. L. Anderson and J. A. Rigney, North Carolina State College; H. H. Strandskov and G. J. Siemens, University of Chicago; H. C. Fryer and D. C. Warren, Kansas State College; M. E. Muhrer and A. G. Hogen, University of Missouri; W. P. Judkins and Donald Comin, Ohio Experimental Station; Donald F. Jones, Connecticut Agricultural Experiment Station; W. T. Federer, E. L. LeClerg, B. L. Wade, F. M. Wadley, and G. F. Sprague, U. S. Department of Agriculture; and various discussionists.

The attendance at these seven sessions varied from 20 to approximately 150 persons. (*From a report by S. S. Wilks.*)

History and Philosophy of Science

The most significant phase of the program of Section L, History and Philosophy of Science, was the participation of a representative group of people in the philosophy of science from every section of the United States. A very rich symposium was held on "Theory and Prediction in Science." After a brief formulation of the problem and issues by Rudolf Carnap, the following persons participated in a panel discussion: A. C. Benjamin, Max Black, Philip Frank,

arl Hempel, Henry Morgenau, Ernest Nagel, F. S. C. orthrop, Hans Reichenbach, Alfred Tarski, and Norert Wiener. A symposium was also held on the "Phisophy of Biophysics," under the chairmanship of . S. C. Northrop, with H. S. Burr, Henry Morgenau, nd Raymond Zirkle participating. The discussion as directed to the problem of the relation between e particle physics and the field physics approach to ology. The group in the philosophy of science seected a program committee consisting of F. S. C. orthrop, chairman; Max Black, Rudolf Carnap, rnest Nagel, Hans Reichenbach, and R. J. Seeger, ex fficio. This committee is already planning two ymposia for the 1946 Boston meeting: one on the Philosophy of Mathematics," under the responsibility f Max Black, and the other, under the responsibility f Ernest Nagel, on the question: "How far does scientific method determine the social ends for which cientific discoveries are used?"

Highlights of the history of science program were wo symposia. A symposium on "Science and Soiety" discussed the relation of government to scientific research. Father Patrick Holloran urged the desirability of independent scientific groups, whereas James B. Conant presented the need for cooperative investigations. The other symposium concerned the "History of Antibiosis." The chairman, John F. Fulton, struck the keynote by stressing the roles played by various persons besides Fleming in the development of penicillin as a therapeutic agent. The prehistory of penicillin (1877–1929) was outlined by Jules Brunel. Recent progress in the use of antibiotics in tuberculosis, with special reference to streptomycin, was presented by William H. Feldman and H. Carwin Hinshaw. Plans have been made for a symposium at the Boston meeting on "The Place of the History of Science in General Education." (*From a report by R. J. Seeger.*)

Medical Sciences

Section N held a symposium on "Medical Science and Industry" in the auditorium of Washington University School of Medicine. The project was arranged in cooperation with the Council on Industrial Health of the American Medical Association. All of the participants were outstanding workers in their separate specialties, and the papers were prepared on invitation from the program committee.

On Wednesday morning the theme was "Atomic Energy." J. Kennedy, of Washington University, introduced the subject by a discussion on the disintegration of the atom. This presentation was followed by a consideration of the hazards and benefits of nuclear energy and the problems of health protection attendant on its production and use. In purposefully employing the atomic bomb as an instrument of destruction there are three effects: (1) from blasts, (2) from burns, and (3) from irradiation. The effects from blasts are the most devastating. The hazards of production as regards humans are limited to exposure to sources of neutrons, gamma, beta, or alpha rays, and are readily subject to control. The fourth paper, in a cognate field, was a report on the results of the therapeutic use of P 32. The data are most encouraging when used in the treatment of certain blood diseases and suggest extending this line of investigation to include C 14 and similar compounds.

In the afternoon five papers were read on the subject of trauma. With the advent of compensation laws, the whole subject of the etiological relationships of trauma to disease became of prime importance. Attempts to obtain objective data by animal experimentation have been most unsatisfactory; thus much of our knowledge is based on clinical experience. Following discussions on the relationship of trauma to diseases of the gastrointestinal tract, lungs and pleura, and heart there was a consideration of "Hostile Dependent Behavior in Rehabilitation" and "Compensation in One Trauma Cancer." In summing up the last subject Maj. G. Seelig stated: "I think that we shall eventually occupy a common ground in our reasoning toward the same conclusion that trauma may provoke, evoke, or incite the growth of cancer in a fashion that we do not now understand."

On Thursday, in morning and afternoon sessions, nine investigators contributed to the two themes: "Occupational Restoration and Positive Health in Employment Procedures" and "Industrial Medicine as a Special Discipline and Industrial Toxicology." Robert Elman, of Washington University School of Medicine, a member of the National Research Council wartime committee on convalescence and rehabilitation, pointed out that experience in Army hospitals showed that the traditional surgical practice of telling a patient nothing and not letting him move was unsatisfactory. By careful attention to psychological, physical, and nutritional aspects the apprehension of a patient is alleviated and convalescence speeded. Harold Storms, of the Rehabilitation Clinic of the Ontario Workmen's Compensation Board, Toronto, described the activities of this group in functional rehabilitation. One of the outstanding features of the morning program was a group of three papers on employer-employee relations. Many examples were drawn from experiences during the war in rapidly expanding industries, on the one hand, and the difficulties arising in such newly created cities as the Oak Ridge Project, where secrecy complicated and added to the mental tension of everyday life.

Following two papers on "The Scope of Occupational Health and Medicine" and "The Program of the Council on Industrial Health of the American Medical Association," J. Carlisle, of Rahway, New Jersey, continued the afternoon program with a report on the results of a study on anoxia in the presence of irritant gases. Treatment was with pure oxygen under slight pressure. The procedure seems to be superior to any other therapeutic method now available.

W. J. McConnell closed the symposium with a consideration of the coordination of safety practices with a progressive hygiene program in the protection of workers in 101 Army ordnance plants involving over 300,000 workers in nine industrial groups during World War II. The results were outstanding and, as the war drew to a close, complete protective measures were in effect.

The subject of the address of the chairman of the section, Warfield T. Longcope, professor of medicine, Johns Hopkins University, was: "The Importance of Researches Upon War Gases to Clinical Medicine." This served as a very fitting terminal paper for the symposium. New methods of treating heavy metal poisoning, certain diseases of the blood, and edema of the lungs were developed as a result of this work when it seemed apparent that gas warfare would be unlikely. There was considerable evidence that phosgene gave temporary relief in Hodgkin's disease and that PF3 had value in the treatment of glaucoma.

The program of Section N was in every way a successful one and suggests the continuation of the plan of arranging symposia with invited papers for future meetings. (*From a report by M. H. Soule.*)

Agriculture

In a joint meeting with Section E in the Kiel Auditorium a symposium was held on Soils, Thursday morning. W. A. Albrecht presided. This was the first half of a larger symposium, the theme of which was the relation of soils to plants, animals, and people. This theme was ably introduced by Charles E. Kellogg, chief, U. S. Soil Survey, who showed not only the continuous dependence of the human race upon the soil from the earliest dawn of its existence, but also the influence of soil characteristics on the distribution and movement of the world's human population and on the great civilizations of the past and present.

Pedology, the study of the soil, has grown to the stature of an independent science within the short space of less than a century. That this new science rests upon a solid foundation and has made a permanent place for itself among its older sisters, geology, botany, chemistry, etc., was made clear by Walter P. Kelley, University of California, in his critical analysis of the modern concepts of soil science, and by Frank F. Riecken, Iowa State College, who presented the causes of divergence in the character of soils during their development.

The thousands of widely diverse soil types scattered over the earth have been forced into a relatively few molds—or categories—by Nature's all-powerful forces of climate (mainly temperature and humidity) impinging upon rocks and other soil parent material for long periods of time. Regional and local modifications have been caused by biological factors, such as type of vegetative cover, by the contour of the land surface, and by other forces. The soil scientist is finding order, not chaos, and clear-cut evolutionary development among soils just as truly as among plants and animals.

That the addition of certain substances to soils would increase crop yields was known more than 2,000 years ago. Progress in the effective use of fertilizers, however, has occurred almost entirely within the past century, and even now in actual practice it is almost wholly empirical. R. H. Bray, University of Illinois, discussed the chemical status of nutrient substances in soils and their mobility or nonmobility as determining factors in the rate and mechanism of uptake by growing plants. Based on this knowledge, methods for quantitative estimation of the critically important forms of the nutrient elements were developed, as well as mathematical equations for translating these results into quantitative fertilizer requirements and predicted increases in crop yields.

J. E. Greaves, Utah State Agricultural College, was unable to be present to discuss factors influencing the composition of wheat and flour and their relation to nutrition.

The session was attended by nearly 100 men and women representing soils, agronomy, chemistry, geology, geography, social sciences, and farm and home advisers.

The American Society for Horticultural Science held its three-day session in St. Louis with 11 sectional meetings and 3 joint meetings, together with 2 evening sessions.

The nature of the discussions and the interest in the various phases of horticulture are shown by the grouping of the papers into general sessions on fruit crops, physiology of vegetables, physiology of fruits, floriculture and ornamental horticulture, fruit storage and processing, chemical weed control, propagation, nut crops, and small fruits.

Joint sessions were held with the Biometrical Section of the American Statistical Association on plot arrangement; with the American Phytopathological

Society on potato diseases; and with Section O, the American Society of Plant Physiologists, and the Physiological Section of the Botanical Society of America on mineral nutrition of plants and animals. Evening round table discussions dealt with teaching methods, extension methods, and maintenance of plant genetic stocks throughout the world for breeding of fruits, vegetables, and ornamentals. An afternoon session was devoted to physiological problems with fruits and vegetables in consumer packages.

As has been the custom of the Society for many years, the banquet and social evening was in charge of the local horticultural group, under the chairmanship of T. J. Talbert, head of the Department of Horticulture, University of Missouri.

Announcement was made of the award of the Leonard H. Vaughan Memorial Award in Horticulture for outstanding horticultural papers published in the *Proceedings of the American Society for Horticultural Science* to Dr. V. T. Stoutemyer, U. S. Plant Introduction Garden, Glenn Dale, Maryland, for his paper on "The Influence of Changes in Molecular Configurations of Several Naphthyl Growth Substances on the Rooting Responses of Cuttings," and to Dr. P. W. Zimmerman and Dr. A. E. Hitchcock, of the Boyce Thompson Institute for Plant Research, for their paper, "Substances Effective for Increasing Fruit Set and Inducing Seedless Tomatoes."

Officers elected for 1946 were: president, G. F. Potter, USDA, Bogalusa, Louisiana; vice-president, J. E. Knott, University of California, Davis; sectional chairmen, A. L. Schrader, University of Maryland, College Park; R. A. McGinty, Clemson Agricultural College, Clemson, South Carolina; and S. L. Emsweller, USDA, Beltsville, Maryland; and secretary-treasurer, H. B. Tukey, Michigan State College, East Lansing, Michigan. (*From a report by H. B. Tukey.*)

President Tussing presided at the business meeting of the Potato Association of America, which was held on 27 March in St. Louis. The report and financial statement of the secretary, W. H. Martin, was read. The present officers of the Association were re-elected.

In discussion of the place and program of the next meeting, the fact was brought out that the certification authorities had been successfully meeting during the war with the International Crop Improvement Association, and that an effort should be made to attract the certification men to the meetings of the Potato Association, or a joint meeting might be arranged with the Crop Improvement Association. The preference of those present was that the next meeting of the Potato Association be held with the International Crop Improvement Association rather than with the AAAS, and that the program should include at least a half day of papers of special interest to the potato certification workers. A program committee, consisting of Marx Koehnke, chairman, H. M. Darling, and F. A. Krantz, was appointed to arrange for the next meeting. (*From a report by John Bushnell.*)

Some 30 members of various scientific and conservation organizations met on 30 March under the chairmanship of C. C. Adams and, after an afternoon of full discussion, adopted a resolution declaring that:

"... it is the sense of this meeting that there should be organized a central service agency for conservation for the purpose of (1) providing its participating organizations with information regarding pending legislative and administrative programs and (2) furnishing such organizations assistance so far as practicable regarding sources of the most competent scientific information available relating to the activities and interests of member organizations."

A proposed amendment that would have added "(3) and to take such action as it sees fit in its own name" was defeated. The meeting elected Howard Zahniser, executive secretary of The Wilderness Society, to be secretary pending a formal organization and instructed Dr. Adams, as chairman, to appoint an Executive Committee to serve with him in arranging for a formal organization, it being declared the sentiment of the meeting that invitations to participate should be extended to as many organizations as the Executive Committee "may deem discreet." The committee so named comprises Dr. Adams as chairman, A. C. Redfield, Charles G. Woodbury, and Mr. Zahniser, and plans for a formal organization are being formulated under the provisional name "American Conservation Service."

On Friday afternoon, 29 March, with Paul J. Kramer presiding, Sections O and K, in joint session with the American Society of Horticultural Science, American Society of Plant Physiologists, and the Physiology Section of the Botanical Society of America, discussed the human and animal nutrition aspects of the Soil-Nutrition Symposium. Attention was focused chiefly on two phases: (a) deficiencies in human and animal nutrition with an attempt to determine the extent to which such deficiencies are traceable to the soil in which the food or feed is grown, and (b) research into the mechanism of metabolic processes.

Wm. A. Albrecht, University of Missouri, in his vice-presidential address sketched the broader phases of the problem and showed that, as soils come into advanced stages of maturity with old-age weathering, they not only decrease in crop-producing capacity but suffer differential losses of different constituents, particularly calcium in excess of potassium, and decreases

in nitrogen. The changes cause shifts in botanical population of plants which can be grown toward those of low value in animal nutrition. Similar changes, but of less extent, may occur within a species.

The South and other regions are confronted by major soil mineral deficiencies or by traditional diets which are seriously deficient in essential vitamins and other nutrition factors. T. D. Spies, Hillman Hospital of Birmingham, Alabama, discussed the incidence, physiology, and amelioration of many of these disturbances, using an impressive array of natural color photographs of symptoms in human subjects.

C. F. Huffman, Michigan State College, discussing "Nutritional Deficiencies in Farm Animals in Relation to Soil and Plant Composition," classified the essential mineral elements of the dietary into two groups. Cobalt, phosphorus, iodine, copper, sodium, chlorine, and occasionally calcium may be sufficiently low in the diet because of soil shortages or unavailability to produce nutritional diseases in livestock. Elements in the second group, including potassium, magnesium, manganese, iron, and zinc, are required by animals, but a deficiency of these elements has not been observed in ruminants under farm conditions. The speaker reviewed recent research which gives conflicting evidence as to the relation between fertilizer use and live weight increases of livestock, and which makes evident the need for further controlled research in this field.

The two succeeding papers were concerned with problems of metabolism studies in living cells. Kurt Stern, Brooklyn Polytechnic Institute, and Kurt Salomon, Washington University School of Medicine, joined in a critical study of iron porphyrin proteins in biological oxidations, the role of nonporphyrin iron and of manganese in fermentation, the functions of hemoglobin iron, hemocyanin copper, and zinc in carbonic anhydrase in the transport and exchange of carbon dioxide and oxygen. The role of other catalysts containing heavy metals in special reactions of vital importance was also discussed briefly.

Philip R. White, Institute for Cancer Research, reported on a critical study of techniques for investigating the nutrition of excised tissues. Culture solutions of fully known constitution are used in plant tissue studies. In adapting these methods to animal tissues resort has been made to heterogeneous mixtures of unknown composition, with a resulting limitation on the kinds of investigation which can be pursued. The author makes a plea for intensive research directed toward the production of improved culture solutions in order to broaden the scope and increase the precision of this type of work.

This session was attended by 450 people representing many fields of research, nearly one-third of whom were forced to leave early because of inadequate seating facilities. (*From a report by E. E. DeTurk.*)

Education

Five sessions of Section Q, Education, were held, including a joint meeting Thurday afternoon with Section I and the Midwestern Psychological Association. A thread of continuity ran through the various sessions which, exclusive of the joint session, comprised an aggregate of 19 papers. A deliberate effort was made to limit the number of participants in order to provide ample time for each speaker to develop his topic.

The opening session on Wednesday morning was devoted primarily to the question of the implications of the Armed Services educational program to public education, with special emphasis upon audiovisual aids. The afternoon session similarly dealt with the Armed Services testing program and postwar educational reorientation of veterans. On Thursday the discussion turned away from the war setting and toward the guidance and adjustment of civilians and the training of guidance workers. The final session, Friday morning, was given to a consideration of postwar education, cooperative curriculum ventures, and the creation of teaching efficiency.

Attendance at the programs of Section Q is traditionally small. The St. Louis meetings provided no exception, since at no time were more than 25 persons present. The papers read were of distinctly superior quality and clearly deserved larger audiences. Discussion of some of these ran far overtime, and requests for copies, either as reprints or in mimeographed form, indicated their importance. (*From a report by H. C. Koch.*)

Science in General

The American Nature Study Society, at its two sessions held in St. Louis as a part of the AAAS convention, brought together 10 educators and naturalists to discuss the role of such agencies as high schools, state parks and museums, state education and conservation departments, teachers colleges, park services, audubon societies, and academies of science in the promotion of conservation and nature education.

Some of the recognized problems were: (1) how to help teachers and youth leaders obtain a better understanding of sound conservation objectives and practices; (2) how to inspire and influence more administrators to undertake the establishment of conservation curricula; and (3) to meet the need for better literature to support such conservation and nature programs.

It was evident from the talks and discussions that St. Louis and Missouri are well launched on a broad program of conservation instruction continuing the fine work of Harris in science and nature starting back in the 1870's; that the State of Indiana is rapidly forging ahead with a strong program involving a summer training program and a series of school manuals; that the national and state parks have a wonderful opportunity for adult and junior programs in this field and that they are meeting them; and that such agencies as the National Audubon Society and the Philadelphia Academy of Sciences are setting fine examples of sound nature and conservation teaching through their summer nature camps and courses, year-round field trip and lecture programs, screen tours, and wildlife auto tours. (*From a report by R. L. Weaver.*)

A small group of invited scientists met informally as a Council on Methodology of Science for a preliminary discussion of the problem of whether or not the present structure of science is sufficiently strong to carry the rapidly increasing bulk of scientific production. Reference was made to progressive specialization, industrialization, group research, disparity of progress in different fields, growing student influx, research subsidies, educational policies, publication difficulties, increasing popular appeal of science and public responsiveness of scientists; and the effect of these factors on the standards of scientific performance and the efficiency and yield of scientific production. Agreement was reached on the need for more factual information on the psychological, economic, historical, educational, and methodological foundations of science. Emphasis was placed on a clear definition of the objectives of scientific research and on giving the initiative of the individual scientist the widest scope in working toward those objectives. It was recognized, however, that scientific procedure will have to be adjusted to the changing technological, educational, economic, and sociological frame. A full participation of all practicing scientists in this process of shaping their future course was declared desirable. As one means to this end, the group recommended the holding of a series of AAAS symposia dealing with the various facets of the scientific process (education, financing, publication, administration, publicity, etc.), particularly as they affect the individual scientist.

The members of the conference were: A. F. Blakeslee, D. W. Bronk, K. S. Lashley, H. B. Steinbach, B. H. Willier, Sewall Wright, R. M. Yerkes, and Paul Weiss, chairman. (*From a report by Paul Weiss.*)

Six science and mathematics teachers' groups cooperated in the program developed by several cooperating societies of teachers of science and mathematics in connection with the 1946 St. Louis convention of the AAAS, 27–30 March. These were: the American Nature Study Society, the Central Association of Science and Mathematics Teachers, the Cooperative Committee on Science Teaching of the AAAS, the National Association of Biology Teachers, the National Council of Teachers of Mathematics, and the National Science Teachers Association. In all, 16 programs were held, including two dinner meetings. In addition, numerous business and committee meetings were arranged for presentation of reports and the conduct of business. All of the programs were extremely well attended. The number of science teachers present ranged from 50 to 150. The meetings probably attracted more than 1,000 teachers of science.

The dinner meeting of the NSTA on 29 March was devoted to the general theme, "Unity and Action in Science Education." The group was honored by the attendance of James B. Conant, president of the AAAS, and A. J. Carlson, past president of the AAAS. Dr. Carlson also was the chief speaker at the Saturday morning meeting, when he presented an inspirational talk on "Science in the High School." All of the science and mathematics teachers joined in the Saturday evening dinner arranged by the National Association of Biology Teachers, at which the chief speaker was Otis W. Caldwell, general secretary of the AAAS. He addressed the group on: "Of What Does Good Biology Teaching Consist?"

The NSTA announced a high mark in its membership, which has reached the total of 2,300 individual members and 18 affiliated science teacher organizations. Among the important reports presented and approved were: (a) report to the Department of State on the status of science courses and teaching apparatus in the United States. This is to be used as a means of helping the devastated countries of the United Nations to re-establish their programs of science education; (b) standards and criteria for free and low-cost materials for science teaching; (c) the place of science in the education of the consumer.

The programs as a whole considered numerous professional problems now faced by science teachers in the elementary schools, in the junior high school, in the secondary schools, and in the colleges. (*From a report by Morris Meister.*)

Sigma Delta Epsilon, Graduate Women's Scientific Fraternity, held its annual convention in St. Louis on 27–29 March. A meeting of the National Council was held on 27 March. On 28 March, Sigma Delta Epsilon sponsored a luncheon for all women in science. Sixty-one scientific women gathered at the Hotel Statler to become better acquainted with each

other and to hear Virginia Bartow, of the University of Illinois, speak on "Historical Cooperation Among the Sciences." Matters of national business were considered at a breakfast at 8:00 A.M. on 29 March. Delegates from the 15 chapters of the organization, as well as the National Council members, attended this session. National officers, elected for 1946 are as follows: Nina E. Gray, Illinois State Normal University, Normal, president; Edith Quimby, College of Physicians and Surgeons, Columbia University, New York City, first vice-president; Pearl Claus, University of Wisconsin, Madison, second vice-president; Lela V. Barton, Boyce Thompson Institute for Plant Research, Inc., Yonkers, New York, secretary; and Beulah Armstrong, University of Illinois, Urbana, treasurer.

The fraternity will celebrate its 25th birthday in December 1946 at Boston. (*From a report by Lela V. Barton.*)

The Science Exhibition

Once again the leading supplies of scientific apparatus, equipment, supplies, and books cooperated to present their latest items for inspection by the members attending the AAAS meetings. Nearly all of the exhibitors were able to show new or improved products because of research carried on in conjunction with their activities of supplying the armed forces during the war. In addition to the usual large number of commercial exhibitors there were a limited number of scientific exhibits. The small number of the latter was due to the short time for preparation and the uncertainty of securing approval for releasing war research still covered by security regulations.

The Science Library was one of the most popular exhibits at the meetings. Books were received from nearly 50 different publishers in addition to a score or more of overseas publishing houses. The foreign items came from Canada, England, Russia, Poland, The Netherlands, France, Sweden, Belgium, and Norway.

Through the cooperation of the National Science Teachers Association and the Army Air Forces, two large exhibits on training methods and equipment from Scott Field and the Seventh Defense Command at Omaha, Nebraska, were open for the entire period of the exhibition. The U. S. Public Health Service, the Library of Congress, the Army Medical Library, the National Roster of Scientific and Specialized Personnel, and the Smithsonian Institution were other governmental agencies which provided exhibits.

The exhibition staff of the Washington office has already begun work on the exhibition to be held in conjunction with the December meeting in Boston. A local committee in charge of scientific exhibits is to be appointed, and invitations to participate will be issued shortly.

News and Notes

Capt. R. D. Bennett, technical director, Naval Ordnance Laboratory, spoke on "The Future of Science Under Government" at the meeting of the Philosophical Society of Washington on 16 February.

S. Eilenberg, of the University of Michigan, has been appointed professor of mathematics at Indiana University.

Dr. Herbert E. Longenecker has been appointed dean of the Graduate School at the University of Pittsburgh. Dr. Longenecker, who is dean of research in the natural sciences, succeeds Dr. William T. Root, who died early in 1945. A nutrition authority, he holds many national offices. He is expert consultant on fats and oils for the Office of the Quartermaster General, and a member of the steering committee of the Food and Nutrition Board, National Research Council. He has been a member of its committee on fats since 1942 and chairman since 1943.

Dr. Max E. Chilcote, of the Department of Physiological Chemistry, Loyola University School of Medicine, Chicago, has been appointed Nutrition Foundation Research Fellow in the Department of Agricultural and Biological Chemistry, Pennsylvania State College. Dr. Chilcote will work with Dr. N. B. Guerrant on methods for the estimation of vitamin A and carotene.

Maj. Rafael Rodriguez-Molina, Medical Corps, has been awarded the Army Commendation Ribbon for his service as assistant chief and chief of the Medical Service, 161st General Hospital, A.P.O. 851, U. S. Army.

Dr. Bennett Frank Buie has been appointed professor in the Geology Department at the University of South Carolina, Columbia. Dr. Buie has recently been released from the Army, where he had been serving as a major with the Corps of Engineers attached to the Persian Gulf Command.

Dr. W. A. Shurcliff, scientific and technical adviser to the New York State Department of Commerce, has been given temporary release by Governor Dewey to

serve as official historian of "Operation Crossroads," to be carried out in the Marshall Islands this spring by Vice-Admiral Blandy's Joint Task Force One. Dr. Shureliff was chosen for this new assignment in view of his recent experience in helping edit the "Smyth Report."

Dr. Richard P. Goldthwait, formerly of Brown University and during the war in charge of special equipment investigations for the Army Air Corps at Wright Field, has been appointed associate professor of geology at the Ohio State University.

Philip S. Smith, chief Alaskan geologist of the U. S. Geological Survey, retired from government service on 31 March 1946.

Prof. Franz Knoop has been located and interviewed by a former student of mine. He was in good health at the age of 70, although he had lost 40 pounds. As of 1 April 1946, he retired from his position at the University of Tübingen, and was succeeded by Adolf Butenandt.—*Howard B. Lewis* (University of Michigan).

Dr. Julian B. Rotter, recently separated from the Army, where he was on duty in the AAF Convalescent Hospitals as a clinical psychologist with the rank of first lieutenant, has been appointed assistant professor of psychology at Ohio State University.

Dr. Arthur W. Adamson, former project leader in the research at Oak Ridge, Tennessee, has been appointed assistant professor of chemistry at the University of Southern California.

Dr. James M. Severens, formerly on the faculty of the University of Illinois, is now bacteriologist and director of research and development with the American Scientific Laboratories, Polo, Illinois.

Dr. Horace E. Wood, II, after three years of service as lieutenant and captain in the AAF, has resumed his former position as professor of biology, University of Newark, and research associate in fossil mammals, American Museum of Natural History, New York City.

Prof. David L. Arm, head of the Department of Mechanical Engineering at Iowa State College, has resigned his position to become dean of the School of Engineering at the University of Delaware.

Dr. Harold A. Abramson, assistant professor of physiology at Columbia University, recently addressed the Philadelphia Allergy Society and the staffs of the Pratt Diagnostic Hospital and the New England Medical Center, Boston. In his address, "Aerosol Therapy of the Lungs and Bronchi," Dr. Abramson outlined the general principles of aerosol therapy, described the initiation of the penicillin aerosol therapy program by the Technical Division, Office of the Chief, Chemical Warfare Service, in 1942, and amplified in detail that part of the lung therapy program which was under his direction while he was a member of the staff of the Commanding General, Technical Division, Chemical Warfare Service.

Dr. Clifford S. Garner has been appointed assistant professor of chemistry at the University of California at Los Angeles where he will carry on a program of research in nuclear chemistry. Dr. Garner has been with the Los Alamos Nuclear Bomb Laboratory for the past three years.

Dr. N. Ercoli, formerly with the Research Laboratories of Hoffmann-La Roche in Nutley, New Jersey, has been appointed head of the Laboratory of Pharmacology and Chemotherapy at the Warner Institute for Therapeutic Research, New York City.

Dr. Wayne K. Wilmarth, formerly instructor in chemistry at the University of California, Berkeley, has been appointed assistant professor of chemistry at the University of Southern California.

Dr. E. D. Merrill, director of the Arnold Arboretum, Harvard University, has been appointed as a member of the Advisory Scientific Board of the Gorgas Memorial Institute of Tropical and Preventive Medicine, succeeding the late Dr. Thomas Barbour.

Dr. L. Hissink, Borromeus Clinic, Bandoeng, Java, Dutch East Indies, is confirming his investigations on a plasma substitute, Capain, which he began during the war at the Surgical Clinic of the Medical School in Groningen, Holland. He writes: "The resistance of the (Indonesian) people here is much lower than in Europe. After some bigger operations we often have to treat the postoperative shock." Since not enough blood or plasma is available, intravenous protein hydrolysates are being tried.—*H. Necheles* (Michael Reese Hospital, Chicago).

Dr. Stanley B. Williams, formerly instructor in psychology at Brown University and recently released from active duty in the Navy, has been appointed assistant professor of psychology at Johns Hopkins University.

Dr. Roger G. Barker, formerly of Stanford University, has accepted the G. Stanley Hall chair in genetic psychology at Clark University.

Dr. Waldo Shumway, professor of zoology, University of Illinois, has returned to the University after four years active duty in the Army of the United States. He served as a Colonel in the General Staff Corps and was assigned first to the Special Service

Division and later to the Planning Division of Army Service Forces. He was awarded the Legion of Merit and the Army Commendation Ribbon.

Dr. Wendell R. Garner, formerly special research associate in psychology at Harvard University, has been appointed instructor in psychology at Johns Hopkins University.

R. P. Fischer, formerly research examiner at the University of Illinois, has been appointed full professor of psychology and head of the Department of Psychology at Birmingham-Southern College, Birmingham, Alabama.

Dr. Harry Turney-High, professor of anthropology and sociology and chairman, Department of Economics and Sociology at Montana State University, has returned after more than three years active service with the Army. Dr. Turney-High served overseas for a considerable portion of the period during which he was absent and was a member of the staff of the Provost Marshal.

Dr. Russell B. Stevens has been appointed assistant professor in the Department of Biology at the University of Louisville. He was released from the Army in January after nearly four years in the Medical Department, during which time he saw service in New Guinea and the Philippines.

Dr. Paul L. Risley, formerly associate professor of zoology at the State University of Iowa, is now professor and head of the Department of Biology at the University of Oregon. Prof. H. B. Yocom, former head of the Department, is on leave of absence for the current year. Due to ill health, he has retired from full-time duties.

Dr. Albert Kenrick Fisher, former biologist of the U. S. Biological Survey and since 1931 honorary collaborator in biology of the Smithsonian Institution, celebrated his ninetieth birthday on 21 March 1946. On that evening a group of about 40 of Dr. Fisher's scientific and professional friends gave a dinner in his honor at the Cosmos Club in Washington. "Unfolding the Life of Dr. A. K." was the topic for the after-dinner program. Toastmaster for the occasion was Dr. T. S. Palmer, retired naturalist and one of Dr. Fisher's associates during a good part of his 46 years of government service. Paul H. Oehser, of the Smithsonian Institution, spoke on "Dr. A. K. as We Know Him," and Howard Zahniser, of the Wilderness Society, on "Dr. A. K. as a Naturalist." Others paid high tribute to Dr. Fisher's long and useful service as an economic ornithologist and mammalogist, to his great capacity for friendship and companionship, and to his likable and infectious personality.

Robert B. MacMullin, formerly manager of development of the Mathieson Alkali Works, Inc., announces the opening of a consulting practice in the field of chemical engineering, with temporary offices at 824 Troy Avenue, Niagara Falls, New York. Mr. MacMullin has just returned from a six-month tour of duty in Germany as technical coordinator for the Foreign Economic Administration and the Department of Commerce.

Dr. M. J. Schiffrin has been appointed research consultant to the Medical Division of Hoffman-La Roche, Inc., after completing 45 months service with the AAF. Previously, Dr. Schiffrin was in the Department of Physiology of Northwestern University Medical School.

Dr. C. C. Speidel, professor of anatomy, University of Virginia, Charlottesville, spoke on "Living Cells in Action as Revealed by Fast-motion Cine-photo Micrography" before the Sigma Xi Chapter of North Carolina State College on 26 March.

Dr. T. G. Yuncker, professor of botany at DePauw University, has been appointed visiting research professor at the University of Illinois for the year 1946-47. He will continue studies on the taxonomy of the Piperaceae, left uncompleted by the late Prof. William Trelease.

Announcements

A School of Forestry has been authorized by the Regents of the University of California. Work in forestry has been carried on previously by a department within the College of Agriculture which has achieved wide recognition for its work. The establishment of the school allows the faculty to operate on a higher administrative level, opens the way to program expansion, and will make possible the organization of a fifth professional year of study leading to a Master's degree in the field. This is the twelfth such school in the United States to offer professional forestry training, according to officials.

Polytechnic Research and Development Company, Inc., successor to P. I. B. Products, Inc., announces the opening of complete facilities for consultation, research, and development in the field of applied physics and microwave electronics at 66 Court Street, Brooklyn 2, New York.

The Louisiana State University Chapter of the Society of Sigma Xi has just established two annual awards for students, a $50 award to the outstanding graduating senior and a $100 award to the most capable Master's candidate. The latter prize was

made possible through the generosity of Dr. Lester R. Williams.

The Swedish Board of Education has suggested that English should replace German as the primary foreign language in all secondary schools from the autumn of 1946. This change will take place successively, beginning with the lowest class.

The Board observes that Sweden's relations with the English-speaking world, in the economic as well as in the cultural field, had already strongly developed during the prewar years, while her relations with German-speaking countries showed a decline. Subsequent world events have further contributed to this trend. The interest in Russian and Spanish has likewise increased considerably in Sweden, and the number of pupils studying these languages has multiplied compared with the prewar years.—*Swedish International Press Bureau.*

The American Institute of Nutrition announces that the Mead Johnson and Company Prize for 1945 has been awarded to Dr. Irwin C. Gunsalus, associate professor of bacteriology, Cornell University, and to Dr. Esmond E. Snell, associate professor of biochemistry, University of Wisconsin, for their discoveries and investigations in the field of the B-complex vitamins with special reference to pyridoxal and pyridoxamine.

The Institute also announces the granting of the Borden Award in nutrition to Dr. Philip C. Jeans, professor of pediatrics, College of Medicine, State University of Iowa, and to Dr. Genevieve Stearns, research professor of pediatrics, College of Medicine, State University of Iowa, for their valuable contributions on the nutritive significance of milk and various components of milk in the maintenance of infant and child health.

The Belgian American Educational Foundation, 420 Lexington Avenue, New York 17, New York, has invited 22 Belgian scientists to visit the United States for short study-travel trips during the year, according to Perrin C. Galpin, president. The majority of those invited will arrive before summer. The Fonds National de la Recherche Scientifique of Brussels made the initial selection of 18 men, while 4 were invited directly by the foundation in New York.

The names, principal subjects of study, and Belgian university or other affiliation are: Gerard Baptist, agricultural economics, State Agricultural High School, Ghent; Raymond Bouillenne, botany, Liège; Jean Brachet, biology, Brussels; Raymond Breckpot, chemistry, Louvain; Frederic Bremer, neurology, Brussels; Lucien Brull, internal medicine, Liège; Gaston Dept, history, Ghent; Louis D'Or, chemistry, Liège; Corneille Heymans, physiology, Ghent; Georges Homes, industrial physics, Polytechnic School, Mons; Maurice Houyoux, architecture, Albert I Library; Jean La Barre, pharmacology, Brussels; Michel Legraye, mineralogy, Liège; Jules Lespes, administrative law, Brussels; Gustave Magnel, engineering, tests of materials, Ghent; Joseph Maisin, cancer research, Louvain; Charles Manneback, theoretical physics, Louvain; Paul Martin, surgery, Brussels; Walter Mund, physical chemistry, Louvain; Romaan Ruyssen, chemistry, Ghent; Jan Frans Vanderheijden, library science, Albert I Library; and Victor Van Straelen, paleontology, Royal Museum of Natural History.

All but five of these men have studied in the United States between the two wars. Each visitor will stay a minimum of one month in this country.

The Geology Department of the University of South Carolina has recently acquired the Colburn Mineral Collection. This collection is especially rich in rare and beautiful minerals from the southern Appalachians.

The Sixth Annual Broadcast Engineering Conference met in Columbus, Ohio, during the week of 18 March. The Conference was sponsored by Ohio State University and the University of Illinois, with the cooperation of the National Association of Broadcasters and the Institute of Radio Engineers.

Phi Sigma Society installed a new chapter, Alpha Sigma, at the University of Texas on 2 February 1946. Dr. Efrén C. del Pozo, of the National University of Mexico, and Dr. Robert R. Williams, of the University of Texas, were elected to honorary memberships.

Tests in the United States show that the new British insecticide, sometimes referred to as benzene hexachloride, is not a replacement of DDT and has at present serious shortcomings, Dr. W. H. Tisdale, director of the Du Pont Pest Control Research Laboratory, announced recently. This is the insecticide disclosed in a recent congressional hearing on the 1947 Agricultural Department supply bill. It was said to be seven times more effective against flies than DDT.

"While it shows real promise as an additional lethal weapon against many insect pests," Dr. Tisdale explained, "hexa-chloro-cyclohexane, to use its correct chemical name, will require more research work before it can contribute importantly to the welfare of man. It has a most disagreeable, pungent odor and does not possess the long-lasting toxicity in the field that makes DDT so outstanding."

Du Pont has widely tested hexa-chloro-cyclohexane and distributed samples to state and federal agencies. Experimental reports point to limited use of the in-

secticide for controlling household, storage, and livestock insects because of the odor. It is more toxic to flies and cockroaches than DDT. In agriculture, tests show it is superior to DDT against such major pests as aphids, grasshoppers, wire worms, and several cotton insects including the boll weevil. However, the Du Pont scientist pointed out, under normal weather conditions where these pests occur in this country, the insecticide is not effective for more than 2 to 4 days. Early reports also show that it is more likely to damage foliage than DDT, especially tender truck crops.

"We will continue to investigate this new product and its possibilities," Dr. Tisdale said, "including the production of a more effective and less odorous form."

Fifty high school chemistry and physics teachers, selected from 10 northeastern states, will be appointed to all-expense General Electric Science Fellowships at Union College this summer, it has been announced by Dr. Carter Davidson, president.

Forty fellowships were made available last summer in the field of physics. This year 50 fellowships will be divided between chemistry, physics, and general science teachers who qualify.

A special course of study, designed to bring the fellows information concerning latest advances in chemistry and physics, will be conducted by the faculty of Union College in cooperation with the scientific staff of the General Electric Company.

The fellowships will cover traveling expenses, living expenses, and tuition at the session which will open 7 July for a six-week term. Graduate credit will be given to qualified applicants.

Formal announcements are being mailed to secondary school principals for transmission to teachers and to individual science teachers in New York, Pennsylvania, New Jersey, Delaware, and the New England states.

The University of British Columbia has announced that the contract has been let for a new physics building, to cost $740,000. Construction will start immediately, and it is expected that the building will be ready for occupancy in January 1947.

The Life Insurance Medical Research Fund, 60 East 42nd Street, New York City, has made grants totaling $126,000 in six university medical schools for research into the causes of cardiovascular diseases.

Recipients of the grants are: Columbia University—Dr. Joseph Victor, Department of Pathology, and Dr. Dickinson W. Richards, Jr., Department of Medicine; University of Minnesota—Dr. Maurice Visscher, Department of Physiology, and Dr. Arthur Kirschbaum, Department of Anatomy; University of Pennsylvania—Dr. H. C. Bazett, Department of Physiology; Southwestern Medical College, Dallas, Texas—Dr. Gladys Fashena, Department of Pediatrics; Washington University, St. Louis—Dr. John R. Smith, Department of Internal Medicine; and Yale University—Dr. John R. Paul, Section of Preventive Medicine.

The University of Hawaii has initiated a project of research in Micronesia to include the biological, physical, and social sciences. A party of four faculty members made a reconnaissance trip to the Marshall, Mariannas, and Caroline Islands from 14 December 1945 to 5 January 1946. The party consisted of Drs. Harold St. John, leader and botanist; John F. Embree, anthropologist; Harvey I. Fisher, zoologist; and Raymond E. Murphy, geographer. The islands visited were: Kwajalien, Ebeye, Majuro, Aur, Arno, Eniwetok, Ponape, Kusaie, Pingelap, Guam, Peleliu, Angaur, and Korror. The trip was made possible through the assistance of the U. S. Navy.

The U. S. Navy Hydrographic Office has recently established a Division of Oceanography which, according to Rear Adm. R. O. Glover, USN, Hydrographer, will provide for increased responsibilities in oceanography recently assigned by the Secretary of the Navy.

Experience during the war has shown that a considerable expansion in knowledge of the oceans is necessary to guide the development of new naval equipment and to aid in strategic and tactical planning. A great increase in fundamental oceanographic research will be required, since present basic oceanographic knowledge has been extended to the limit in its practical application during the war. In addition, new oceanographic techniques have opened many new possibilities of further fundamental investigations.

It is believed that such basic oceanographic research would be of value not only to the Navy but also to many other governmental activities interested in the oceans, their land and air borders, and the organisms living in the sea, as well as to scientific institutions and to various commercial interests. For example, the increase in air travel over water has given increased emphasis to problems of maritime meteorology and air sea rescue, requiring a knowledge of ocean currents. The extension of United States responsibility to regions of the western Pacific has greatly added to the national interest in geophysical and other problems of those areas, of which oceanographic problems are an integral part. Development of new fisheries and conservation of existing fisheries resources may in the future depend more and more on better oceanographic knowledge.

By expanding its oceanographic work, the Hydrographic Office will be continuing its tradition of service to the mariner and will afford other agencies a facility

or coordination of oceanographic observations and research. The Hydrographer intends to maintain a central oceanographic library, central files of oceanographic data (to be published in a special bulletin), and a bibliographic service, and to provide charts and manuals utilizing the results of the most recent research. In carrying out this work, the Hydrographic Office will not only make use of the services of its own personnel in the newly established Division of Oceanography, but also will give financial support to oceanographic institutions to permit them to expand their facilities for basic research of interest to the Navy and other governmental agencies. In addition to publications of immediate practical use to mariners, the Hydrographer proposes to publish a series of technical studies which will be of interest to those working in applied oceanography as well as to personnel at research institutions both in the United States and abroad.

To insure an organization most useful to the Government and the maritime interests of the Nation, an Advisory Committee, consisting of representatives of interested activities in the Navy and other government agencies, is being formed to advise the Hydrographer concerning oceanographic problems of special interest to the agencies represented, to assist in coordinating governmental research in oceanography, and to give continuing endorsement to the program. Cooperation of this sort should prove to be a most economical means of furthering the oceanographic interests of the country.

A new tanning compound for sole leather, developed synthetically by chemists, is believed by them to be superior to the natural product formerly obtained from chestnut trees. It is an important development because the natural chestnut material is no longer available domestically, most American chestnuts having been killed by a blight.

This synthetic tannin was developed by chemists of the Monsanto Chemical Company, which claims that it imparts to sole leather a fine, smooth grain as well as desirable qualities of tightness, firmness, pliability, and excellent resistance to abrasion, water, and wear.

The chemical composition of the new tannin is not announced. It is, however, made from domestic raw material, and was developed by examining the complicated molecular structure of natural tannin extracts, and then creating a new product through chemical synthesis. In the development, chemists of the Monsanto Company and the University of Cincinnati leather research laboratory cooperated—*Science Service.*

The National Social Science Honor Society, Pi Gamma Mu, now affiliated (29 March 1946) with the AAAS, gave a luncheon 29 March 1946 at the Claridge Hotel, St. Louis, for the presiding officers and participants in the several sessions of Section K on the "Impact of Technology on Society." Dr. Leroy Allen, national executive secretary of Pi Gamma Mu and professor of religion in Southwestern College, presided, and the national president, Dr. S. Howard Patterson, professor of economics in the University of Pennsylvania, presented his vice-presidential address to Section K on "The Present Challenge to Social Scientists." Dr. John Donaldson, national first vice-president and professor of political economy in the George Washington University, gave an address of welcome. About 40 guests were in attendance.

Immediately after the luncheon, at 2:30 P.M. in an adjoining room at the Hotel Claridge, this year's Pi Gamma Mu Lecture on "Science and Religion" was presented by Dr. Edwin McNeill Poteat, president of the Colgate-Rochester Divinity School. Dr. Patterson presided. (*From a report by Leroy Allen.*)

Six new members have been appointed to the faculty of the Technological Institute of Northwestern University, according to Ovid W. Eshbach, dean of the Institute. Capt. George G. Lamb, recently discharged from the Navy where he coordinated research on aviation fuels, was appointed professor of chemical engineering. Miklos Hetenyi, formerly in charge of the photoelasticity laboratory of the Westinghouse Electric Company, was appointed professor of theoretical and applied mechanics. George Sommerman, who formerly conducted radio research for the Navy under the OSRD, and Alexander Wing, Jr., formerly on the staffs of the pre-radar school and the radio research laboratory at Harvard University, were appointed associate professors of electrical engineering. Robert R. Buss, also of the Harvard radio laboratory, and Lt. John Lyon, recently discharged from the Navy, were appointed assistant professors of electrical engineering.

Five of 16 planned research projects have now been completed by the Hormel Institute in cooperation with the University of Minnesota. These are: "Survey of Literature and Experimental Studies on the Nutritive Value of Soybeans"; "The Nature and Identity of the Natural Preservatives in Animal Fats and the Development of an Analytical Method for Their Measurement"; "Secondary Antioxidants"; "Studies of the Stability of Dehydrated Meats," a war project; and an investigation concerning the use of sulfonamide in treatment of surface wounds, under the sponsorship of Sharpe and Dohme, Inc. Copies of the research projects and a list of papers published or pending may be obtained by writing to The Hormel Institute, Austin, Minnesota.

The Institute was founded in 1942 by agreement between the University of Minnesota and the Hormel Foundation. The Board, made up of five men selected by the University, consists of: Theodore C. Blegen, dean of the Graduate School, University of Minnesota; C. H. Bailey, dean and director, Department of Agriculture, University of Minnesota; R. P. Crane, Board of Trustees, Hormel Foundation; F. C. Mann, professor of experimental surgery, Mayo Foundation; and Walter M. Lauer, professor of organic chemistry, University of Minnesota. The executive director, who supervises all operations of the Institute, is Dr. H. O. Halvorson, professor of bacteriology, University of Minnesota. He is assisted by Dr. Walter O. Lundberg, associate professor of physiological chemistry. All members of the staff from the University retain their faculty status.

At present 5 laboratories are in operation, but the Institute hopes to expand this to 8 or 10 and to increase the range of research as soon as possible.

The Institute for Research in Child Psychology has been reorganized as the Institute for Research in Clinical and Child Psychology. At present, the Advisory Council consists of the following members: Gardner Murphy, chairman; Philip Curoe, Oskar Diethelm, W. H. Gantt, Clark L. Hull, Arthur T. Jersild, Wolfgang Köhler, William S. Langford, H. S. Liddell, Jules Masserman, Dorothea McCarthy, Emil Oberholzer, Frank J. O'Brien, James M. O'Gorman, and Bernard S. Wortis.

Officers elected at the annual meeting are: Livingston Welch, director; Louis Long, treasurer; and Bernard F. Riess, secretary.

A new Department of Biochemistry at Harvard has been established in the Faculty of Arts and Sciences. It will be composed of three subdepartments, Biological Chemistry and Physical Chemistry at the Harvard Medical School in Boston, and a new subdepartment of Biochemistry in Cambridge.

Heretofore, research and graduate instruction in biochemistry have been centered chiefly in the Medical School, primarily because the development of this science in this country has been largely due to its long-recognized importance in the medical curriculum. More recently, an increasing interest in biochemical problems and methods has been displayed by those laboring in the closely allied fields of physics, chemistry, and biology.

The establishment of the new subdepartment in Cambridge will now provide additional facilities for research and instruction in biochemistry in close proximity to the Departments of Biology and Chemistry. It will be staffed by a number of new appointments, and it is expected that certain members of the Departments of Biology and Chemistry, whose interests lie closest to the area of biochemistry, will become part-time members of the new subdepartment. A closer integration of the biochemical interests and needs of all students and faculty members should thus be achieved.

The ever-widening applications of biochemistry, not only to medicine but to agriculture, public health, and to the pharmaceutical, chemical, and food industries, have created a great need for well-trained biochemists to carry on research and teaching in these fields.

Dr. L. J. Havas, formerly of the University of Brussels, Belgium, and at present in Budapest, Hungary, has written to L. Marton, of Stanford University, that he is attempting to write a book on colchicine and its effects and would be grateful to receive all publications on this subject. He appeals to fellow workers in this same field to send him publications on colchicine and related subjects (polyploidizing agents, animal and plant hormones, carcinogenic substances, etc.). He also requests most recent publications on the methods of culture of penicillium and the extraction methods of penicillin. His present address is: Hungarian Agricultural University, Horticultural Faculty, Institute of Special Fruit Growing, Nagyboldogasszony utja 45, Budapest XI, Hungary.

Louisiana State University has announced the establishment of two industrial fellowships in zoology under the direction of Dr. George H. Mickey, associate professor of zoology. The purpose of the research is to study the effects of petroleum refinery wastes upon native fishes of Louisiana streams. A total of $10,550.88 for a three-year period was contributed by six oil companies: Cities Service Refinery, Standard Oil Company, Shell Oil Company, Pan-American Petroleum Corporation, Continental Oil Company, and Chalmette Petroleum Corporation.

The Institute of Statistics, University of North Carolina, announces a statistical summer session to be given at Raleigh from 17 June to 26 July. The science of statistics experienced an exceptionally rapid development during the war. The summer session staff has been chosen for its ability to present the new methods and concepts authoritatively and effectively. Lectures will include descriptions of many recently discovered applications of statistics, as well as both simple and more complex examples of the better known techniques.

The instructional staff consists of: Dr. C. I. Bliss, biometrician, Connecticut Agricultural Experiment Station, and lecturer in biometry at Yale University; Prof. W. G. Cochran, associate director, Institute of

tatistics; Prof. Gertrude Cox, director, Institute of tatistics; Dr. R. A. Fisher, Department of Genetics, niversity of Cambridge; Prof. G. W. Snedecor, di- ector, Statistical Laboratory, Iowa State College; and r. J. Wolfowitz, associate professor, Institute of tatistics.

Eight courses in statistics will be given, including eginning courses in experimental statistics, inter- ediate and advanced courses in design of experi- ents, statistical basis of biological assay, sequential nalysis, mathematical statistics, and advanced experi- ental statistics. Further information may be ob- ained from the Director, Institute of Statistics, North Carolina State College, Raleigh, North Carolina.

The tenth anniversary of the death of Ivan Pavlov, the Russian physiologist who developed the theory of conditioned reflexes, has been celebrated in Moscow by a joint session of the USSR Academy of Sciences, the Academy of Medical Sciences, and the All-Union and Moscow Societies of Physiologists, Biochemists, and Pharmacologists.—*Science Service.*

A Sanitary Engineering and Public Health Research Council of Texas was temporarily organized during the summer of 1945 by representatives of the univer- sities and colleges of Texas interested in research per- taining to sanitary engineering and public health. The objectives of the organization are: to promote research, to facilitate the transfer of information in these fields, and to secure funds for research.

On 7 January 1946, a meeting of the Council was held at the University of Texas, Austin. During this meeting a permanent organization was effected and a program was presented. Annual meetings were planned, with the work of the Council to be carried on by committees for the coming year. Committees appointed included: Committee on Research Resources, with Dean O. V. Adams, of the Texas Technological College, as chairman; Committee on Ways, Means, and Endowments, with Mr. V. M. Ehlers, of the State Health Department, Austin, as chairman; and Com- mittee on Public Information, with Mr. E. E. Mc- Adams, of the Texas League of Municipalities, Austin, as chairman.

Officers of the Council for the coming year are: Dean W. R. Woolrich, of the University of Texas, chairman; Dean O. V. Adams, vice-chairman; Mr. E. E. McAdams, secretary; Dr. J. K. G. Silvey, of North Texas State Teachers College, and Mr. V. M. Ehlers, members of the Executive Committee.

Papers on recent research, presented at the January meeting, dealt with purification of water, algae con- trol, typhus fever control, and a fly-control program. Research projects that might be sponsored by the Council were outlined.

Dr. Stanislas Konopka, director of the Department of Science and Publications of the Ministry of Health in Warsaw, has reported to *Science* on the present status of equipment for medical teaching and re- search in Poland. His report covers the situation as of the latter part of November 1945 and was for- warded by Dr. Leon Dmochowski, of the Imperial Cancer Research Fund, London.

The war twice fought on Polish territory and the occu- pation of Poland during the years 1939–1945 brought destruction to every field of cultural and economic life. The cultural losses must be placed first in importance be- cause in the majority of cases the losses are irretrievable, considering the losses of museum collections, archives and libraries. According to provisional estimates, as far as Polish medicine is concerned, Poland has been deprived of 70 per cent of the equipment of scientific institutes, laboratories, clinics and hospitals; in Warsaw the build- ings too have been destroyed. Eighty per cent of the medical libraries and museum collections in Warsaw have been destroyed or burnt.

Before the war the main source from which Polish doctors derived their professional and scientific knowl- edge were the university libraries and the special med- ical libraries. To the greatest Polish libraries belonged the library of the Warsaw Medical Association, founded in 1820, which contained 67,000 books and medical papers, among them valuable prints from the sixteenth to eighteenth centuries. The second, although much larger library, founded in 1921, was the library of the Military Medical Training Centre. This library was a most active one; it comprised 115,000 volumes, was lending books all over Poland, and possessed a department of bibliography sending on request bibliography from every field of med- icine and was publishing Polish medical bibliography. The annual turnover was fifty to sixty thousand books. Besides these two libraries there existed many smaller ones, such as the library of the Chirurgical Society, Gynaecological Society, the Society of Hygiene, etc., and libraries of university clinics and institutes. Of all these libraries only the ruins remain today. In Cracow and in one or two other provincial centres the libraries have been partially saved. In Warsaw, however, only the libraries of the Ophthalmic, Paediatric and Gynaecolog- ical clinics have been, to some extent, preserved. Alto- gether Warsaw lost irretrievably, mainly through fire, twenty-one medical libraries comprising over 550,000 vol- umes. There is no trace left of the rich museum of the history of medicine. It possessed over 16,000 items, such as old medical instruments, medals, paintings and valu- able collections of old medical documents, manuscripts and prints.

During the fighting in Warsaw all the publishing firms and their stocks were lost. This loss is all the more painful, as Warsaw was the main publishing centre of medical and scientific books. Only a few private libra- ries belonging to medical men remain.

This great dearth of Polish medical books has been increased through the German order published in 1939

forbidding the publication of any Polish books or papers, including all medical books. The Germans, as is well known, also closed all universities.

The Polish medical men and scientists appeal to their colleagues abroad for help in the re-equipment of libraries with books and periodicals. To facilitate and coordinate the help given medical committees for scientific help for Poland have been set up in New York, Moscow, Paris, Stockholm and Zurich. In London the work is centered in the Polish Medical Association.

Plans for major expansion of the University of Rochester's Department of Physics, including additions to the physics building at the River Campus, equipment, and teaching and research staff, were announced recently by President Alan Valentine.

The undertaking will constitute the largest single addition to teaching and research facilities at the University since the College for Men was moved to its new campus in 1930. It is one of the first steps in the 10-year program of postwar expansion, particularly in the College of Arts and Science, made public by President Valentine last fall. Strengthening of the liberal arts and social science fields, chemistry, and engineering departments, with additional buildings to accommodate enlarged personnel and equipment, is included in the long-range program.

The announcement follows closely on the return to the University of Dr. Lee A. DuBridge, professor of physics and chairman of the department, after more than five years leave of absence to serve as director of the NDRC Radiation Laboratory at Massachusetts Institute of Technology.

A nonrecurrent expenditure of $550,000 has been appropriated by the University for an addition to the Bausch and Lomb Building at the River Campus, which houses the Physics Department, and for new equipment. The proportion of the sum to be used for those purposes will be determined after recommendations by Dr. DuBridge. Construction will begin as soon as materials can be obtained.

In addition, the physics budget will be double the department's prewar outlay to permit additions to teaching and research staff, over which Dr. DuBridge also will have supervision.

The Signal Corps Engineering Laboratories have recently organized a Micro Optical Section in the Components and Materials Branch of the Squier Signal Laboratory at Fort Monmouth, New Jersey. The section has been equipped with electron microscope, photographic and direct reading and recording X-ray diffraction apparatus, photographic and direct viewing X-ray radiograph and fluoroscope, grating spectrograph, recording spectrophotometer, interferometer, chemical and petrographic microscopes, apparatus for photomicrography, and other associated equipment for studying the physicochemical properties of Signal Corps materials and components. Major Glenn N. Howatt was officer in charge during the installation of the section, and Dr. V. F. Payne has been civilian chief from its beginning.

Major Howatt went to the Signal Corps from the General Ceramics and Steatite Corporation and has now returned to his former position as chief ceramist. Dr. Payne went to the Signal Corps four years ago from his former position as head of the Chemistry Department of Transylvania College. Dr. B. C. Bradshaw, formerly at Rockefeller Institute, is in charge of electron microscopy and radiology; Dr. Alexander P. de Bretteville, Jr., from the Laboratory of Insulation Research, Massachusetts Institute of Technology, joined the staff to assume charge of the work in X-ray diffraction; Dr. Milton Green, formerly with the Bureau of Standards, is in charge of spectroscopy; Mr. S. Benedict Levin, formerly with the Bureau of Mines, is in charge of optical microscopy; and Miss Pearl Anderson, from Transylvania College, is technical editor.

A grant of $1,200 in support of the research work of Dr. Abraham White has been made to the Mendel Fund of the Department of Physiological Chemistry, Yale University School of Medicine, by the Medical Research Division, Sharp and Dohme.

Farrington Daniels, editorial adviser in chemistry for *Science,* has been honored by having the first nuclear pile for the production of power named after him. Major Gen. L. R. Groves announced 13 April 1946 that the Daniels Pile will be constructed at Oak Ridge, Tennessee. A meeting was held 11 April in New York City to formulate plans for organization; representatives of the Manhattan Engineer District, Army Air Forces, U. S. Navy, Monsanto Chemical Company, General Electric, and Westinghouse were present. Charles Allen Thomas, vice-president and technical director of Monsanto, will be in charge of the project, which is expected to be in operation by early 1947. The design, construction, and operation with auxiliary equipment will cost in the neighborhood of $2,500,000. The plant is regarded as a pilot plant for the production of useful power, and Gen. Groves was careful to state that a considerable amount of work needs to be done "before fissionable material can be brought within the range of economic usability."

A David Anderson-Berry Silver-gilt Medal, together with a sum of money amounting to about 100 pounds, will be awarded in 1947 by the Royal Society

Edinburgh to the person, who, in the opinion of e Council, has recently produced the best work on e therapeutical effect of X-rays on human diseases. pplications for this prize are invited. They may based on both published and unpublished work and hould be accompanied by copies of relevant papers. Applications must be in the hands of the General ecretary, Royal Society of Edinburgh, 22 George treet, Edinburgh 2, by 1 December 1946.

Meetings

The North Carolina Academy of Science will hold ts annual meeting on 3–4 May 1946 at the North Carolina State College of Agriculture and Engineering of the University of North Carolina, Raleigh. This will be the first meeting since 1943.

Dr. A. V. Hill, foreign secretary of the Royal Society and recent recipient of the Companion of Honour Award, will represent England at a science and engineering Forum honoring the centennial of the birth of George Westinghouse, according to Gwilym A. Price, president of the Westinghouse Electric Corporation. The Forum will be held in Pittsburgh on 16-18 May.

The opening session, on "Science and Civilization," to be presided over by Dr. Robert E. Koherty, president of the Carnegie Institute of Technology, will include Dr. Isaiah Bowman, president of Johns Hopkins University, and George W. Merck, president of Merck and Company and special consultant to the War Department.

Four aspects of "The Future of Atomic Energy" will be discussed the initial day of the Forum in a group headed by Dr. Karl T. Compton, president of Massachusetts Institute of Technology. The group will delve into the biological, chemical, explosive, and power possibilities of this new form of energy.

A Nobel Prize winner from Columbia University, Dr. I. I. Rabi, will act as chairman at a dinner that evening at which Dr. Vannevar Bush, president of Carnegie Institution, Washington, and director of OSRD, will speak on "Planning in Science."

The following morning will be given over to "Biological Sciences," headed by Dr. Hugh S. Taylor, dean of the Graduate School, Princeton University. Among the participants will be Dr. Selman A. Waksman, professor of microbiology at Rutgers University. Dr. Frank B. Jewett, president of the National Academy of Sciences, will address a luncheon session on "Horizons in Communications."

The Louisiana Academy of Sciences will hold its annual meetings this year on Friday and Saturday, 3 and 4 May, at Centenary College in Shreveport, Louisiana.

Section K is sponsoring, jointly with the Academy of World Economics, Pi Gamma Mu—the National Social Science Honor Society, and the Army Industrial College, a series of meetings to be held in the auditorium of the National Archives, Washington, D. C., 2 and 3 May 1946. The general subject is "Population and Manpower." The three sessions will be: *Thursday,* 2:00 P.M.—"Trends of Population in the United States"; *Friday,* 9:30 A.M.—"Trends of Population in Foreign Areas"; *Friday,* 2:00 P.M.—"Women in War and Industry."

Dr. Benjamin H. Williams, assistant director of research, Army Industrial College, is chairman of the Program Committee composed of representatives of the cooperating organizations.

Elections

Dr. E. G. Butler, chairman of the Department of Biology, Princeton University, was elected president of the Board of Trustees of *Biological Abstracts* at the annual board meeting held in New York on 2 February 1946. Dr. Butler will succeed Dr. A. F. Blakeslee, of Smith College.

At the same meeting Dr. Luther H. Evans, Librarian of Congress, and Dr. J. J. Willaman, Eastern Regional Research Laboratory, U. S. Department of Agriculture, Philadelphia, were elected members of the Board of Trustees.

Other officers of the board elected were: Dr. E. W. Sinnott, Yale University, vice-president; Dr. D. H. Wenrich, University of Pennsylvania, treasurer; Dr. Robert Gaunt, New York University, secretary. Drs. Butler, Sinnott, and C. N. Frey, of the Standard Brands Laboratories, New York, were elected to the Executive Committee of *Biological Abstracts.*

The editorial and business offices of *Biological Abstracts,* now located in the building of the Department of Zoology at the University of Pennsylvania, will be moved during the next summer to a separate building provided by the University of Pennsylvania to permit necessary expansion.

The American Mathematical Society elected the following officers, at a meeting in November 1945, for terms of two years each: L. R. Ford and Saunders MacLane, vice-presidents; W. L. Ayres, R. H. Bruck, and A. C. Schaeffer, associate secretaries. The following were elected members of editorial committees for terms of three years each: Deane Montgomery, *Bulletin*; A. A. Albert, *Transactions*; J. F. Ritt, *Colloquium Publications*; O. E. Neugebauer, *Mathematical Reviews*; A. W. Tucker, *Mathematical Surveys*; L. M. Graves, *American Journal of Mathematics.* New members-at-large of the Council for three-year terms are: R. P. Boas, R. H. Cameron, R. V. Churchill, Churchill

Eisenhart, and A. P. Morse. Prof. M. H. Stone was appointed as a member of the Editorial Committee of *Mathematical Reviews* to fill the unexpired term of J. D. Tamarkin.

The Council voted to hold the summer meeting of the Society at Cornell University, at a date to be decided later.

Recent Deaths

Prof. Amadeus William Grabau died in Peiping on 20 March, according to the Geological Society of America. Prof. Grabau had resided in China since 1920. His last visit to the United States was in 1933, when he was an invited delegate to the Sixteenth International Geological Congress, held in Washington.

Dr. Henry S. Emerson, 38, assistant professor of biology at Amherst College, died suddenly on 8 March.

German Agricultural and Biological Chemists

Dr. Karl Freudenberg, director of the Institute of Chemistry at the University of Heidelberg, was at the University, but his institute was not open. For the past several years he has been working on the chemistry of the lignins. Dr. Richard Kuhn, director of the Kaiser Wilhelm Medical Research Institute at Heidelberg, was working actively with the approval of the American Military Government. Dr. Heinrich Wieland, director of the Institute of Chemistry at the University of Munich, was under house arrest in Starnberg, 15 or 20 miles out of Munich. His home was occupied by the officer in charge of the local American Military Government. Reasons for his house arrest were not clear, but so far as I could learn, he was not under arrest for political reasons.

Dr. Franz Knoop, head of the Institute of Physiological Chemistry at the University of Tubingen, was still active and in charge of his institute, although most of his colleagues were gone. He has been editor of Hoppe-Seyler's *Zeitschrift fur Physiol. Chem.* for many years. The last publications of the journal were issued in late 1944, but he was unable to give me the exact month when publication was suspended, owing to the fact that the French had "liberated" all of his recent volumes, including the unbound volumes of 1944.

Dr. A. Butenandt, of the Kaiser Wilhelm Institute of Biochemistry at Berlin-Dahlem, was working, with several assistants, in Dr. Knoop's laboratory at Tubingen in the French zone. His home in Berlin had been destroyed and his laboratory damaged. However, his colleague, Dr. Hillmans, remained at Berlin-Dahlem and was conducting studies with rats on potential sources of vegetable proteins for human use when I visited him in Berlin.

Prof. Kurt Maiwald, Institute of Plant Nutrition, Prof. Werner Wohlbier, Institute of Animal Nutrition and Agricultural Chemistry, and Prof. George Lakon and others were still working actively on their regular research projects at the Agricultural High School at Hohenheim, near Stuttgart. Some buildings at Hohenheim were destroyed, and most of their microscopes and research instruments had been removed by the French.

Dr. Paul Koenig, director of the State Tobacco Research Station at Forchheim, near Karlsruhe, was endeavoring to carry on his most important research projects without help. Here also all of the laboratory equipment of value had been taken away. His valuable collection of books on tobacco, however, was not lost.

Prof. W. Stepp, director of the Institute of Internal Medicine at the University of Munich, was under house arrest and was being investigated by the American Military Government. His institute and clinic were badly damaged. A new edition of *Die Vitamine und ihre klinische Anwendung,* published with Kuhnau and Schroeder, was published in 1944.

Prof. K. J. Demeter and most of his staff, of the Dairy Research Institute at Weihenstephan, were under arrest for party activities. However, the old Agricultural High School and Experiment Station at Weihenstephan is still staffed by a number of former staff members who are still working on their old projects. Some of these are as follows: Dr. Fritz Reindel (Chemical Institute), Walter Fromel (soils), and W. Schropp (plant nutrition). The school was occupied by about 300 American soldiers who were studying chemistry and agriculture under the general supervision of Maj. Bartley P. Cardon, former biochemist from the University of California. He was using some of the German professors in seminars and special lectures for advanced students.

Dr. Paul Rosbaud, formerly with Julius Springer Publishing House, informed me that Dr. Otto Warburg, head of the Institute of Cell Physiology at Berlin-Dahlem, was in the American zone at the time of my visit but I did not see him. Dr. Rosbaud was under the impression that Dr. Warburg might return to the Russian zone of occupation and continue his research work under Russian supervision, since all of his valuable instruments and equipment had been moved into the Russian zone. His Berlin-Dahlem Institute, which was undamaged, is occupied by the American Military Government.

These facts were obtained by a personal visit late in 1945.—*R. Adams Dutcher* (Pennsylvania State College).

In the Laboratory

Production of Penicillin X in "Submerged" Surface Cultures

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Division of Microbiological Research, Cutter Laboratories, Berkeley, California

Several references to the potential therapeutic importance of penicillin X have been published (*1, 2, 3, 6*). This compound is of no less interest and importance to plant physiologists and students of mold metabolism than to the clinician, but unfortunately it is not generally available at the present time. The apparatus described below is deemed valuable, since cultures grown in it consistently produce relatively large proportions of this antibiotic agent. The unit was originally devised in an attempt to incorporate in surface cultures the advantages of the deep-vat method of fermentation.

The apparatus is simple in design and may be constructed easily. It will produce a continuous supply of penicillin for several weeks without resterilization or reinoculation. The essential features are shown schematically in Fig. 1 (not drawn to scale).

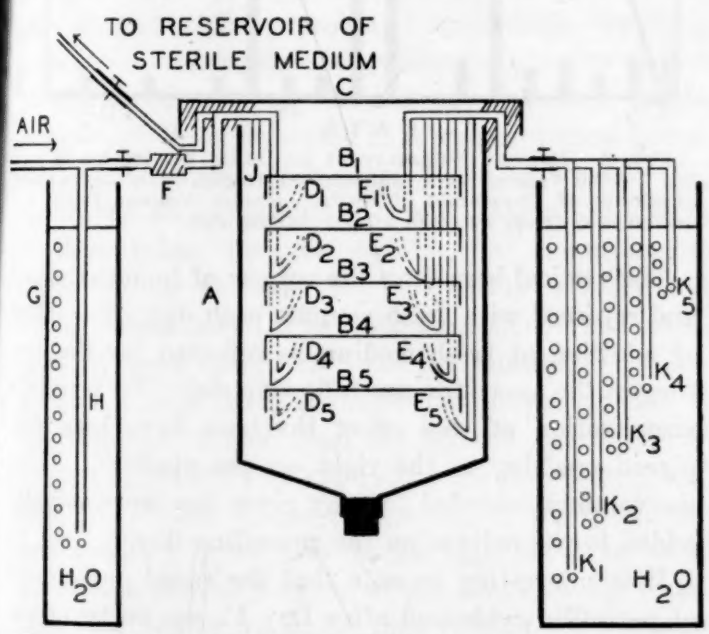

FIG. 1. Schematicized representation of the device for "submerged" surface cultures.

The fermenter, A, may be made any desired capacity, and the rest of the apparatus then may be built accordingly. A convenient laboratory-scale working model has been made from an inverted 10-liter bottle with the bottom removed. Several inverted trays (large Petri dishes or aluminum cake pans have been found practical), B_1, B_2, . . . B_n, are supported by a frame (not shown) consisting of three vertical rods, at the inner periphery of the cylinder, which are attached to a horizontal basal plate anchored by suitable means to the rubber stopper inserted in the mouth of the bottle. Rubber stoppers or sections of heavy rubber tubing slipped around the supporting rods hold the trays in the desired positions. The cover, C, consists of an inverted aluminum cake pan, the inner rim of which is padded with cotton (shown by diagonal lines). Aeration is effected by means of a separate inlet tube, D, and outlet tube, E, for each surface. Tubes and the supporting frame mentioned above may be of glass, stainless steel, aluminum, or Inconel. Incoming air from cylinders or house line passes through the sterile cotton filter, F. The pressure-control device, G, is not essential but is often useful, especially when the pressure on the air line is subject to fluctuation. If the level of tube H is properly adjusted, considerable fluctuation of the pressure of incoming air may occur without causing serious changes in the fermenter and consequent back or forward surging of the fermentation liquor. Samples are withdrawn aseptically from any desired level in the tank by means of a siphon tube (not shown). When not in use for sampling, the exposed end of this tube may be protected by a sterile test tube plugged with cotton. If large quantities are withdrawn, air inlet and outlet tubes should be closed until the initial volume of liquid has been restored by addition of fresh medium. After the mats are well formed, almost all of the solution can be drained from the tank without interfering with subsequent activity of the mold.

In our experiments the dry, sterile fermenter is inoculated by the "dry spore" (*4*) technique with the cover slightly raised at one edge (as for Petri dish inoculation), and then the sterile culture medium is siphoned into it through the J tube, causing the spores to rise and float on the surface of the liquid. During the siphoning operation the air inlet manifold and the outlet tubes, E_1 . . . . E_n, are closed by means of pinch clamps. Consequently, as the liquid rises, an air pocket forms under each plate, providing a surface upon which the mold mat develops. After the fermenter is charged with culture medium, the open ends of the leveling tubes, K_1 . . . . K_n (connected by rubber tubing to E_1 . . . . E_n, respectively), are submerged in water to a depth greater than that necessary to hold the medium under each plate in the fermenter at the desired level, and the tubes are clamped in place. Then the pinchcocks controlling the several

[1] Currently on leave from the University of California, College of Pharmacy, San Francisco.

tubes are opened, and each tube, beginning with the one from the lowest plate and progressing upward, is raised to a point slightly higher than that at which bubbles first appear. Following this adjustment, release of the proper amount of compressed air into all plates simultaneously from the inlet manifold is accompanied by a steady flow of outgoing air from under each plate without a change in the level of the medium and without undue agitation of the surface of the liquid. As long as the apparatus is in operation a stream of air continuously passes over the mold under each plate. During the first three days of operation or until penicillin can be detected in the liquor, the outgoing air is characterized by a foul odor.

The fermenter, air filter with inlet manifold, siphon tubes for introducing media and withdrawing samples, and the outlet tubes are sterilized as one unit. Since the outlet tubes are under continuous positive pressure during a run, it is unnecessary to provide filters for them, but of course they must be connected sterilely to the respective leveling tubes.

In frequently repeated trials with a working model of this apparatus, 40–45 per cent of the penicillin synthesized by *Penicillium notatum* 1249.B4[2] on a medium recommended for surface production of penicillin (*5*) was insoluble in $CHCl_3$ (two extractions in the cold at pH 2.2) but was soluble in amyl acetate. Differential assays were not performed on these samples, but their solubility characteristics were indicative of penicillin X. Yields of 60–70 Oxford units/ml. may be obtained readily in six or seven days on the above medium, and moderate-sized portions of approximately equal potency may be withdrawn at frequent intervals over a period of at least three weeks provided the initial volume of liquor is restored each time by addition of sterile medium. The same strain of mold on the same medium in the conventional bottle method of surface production run simultaneously consistently produced about 85–90 Oxford units/ml., 15–20 per cent of which was insoluble in $CHCl_3$.

The mean ratio of $CHCl_3$ insoluble/$CHCl_3$ soluble penicillins obtained in the apparatus for "submerged" surface cultures (about 10 runs) was 0.44. The lowest ratio obtained was 0.40, and the highest, 0.47. The range in conventional bottle production was 0.14–0.25 with a mean of 0.18.

Results of a typical run with a 10-liter laboratory model of the "submerged" surface fermenter are shown in Fig. 2. For this run the apparatus was set up with four plates and was charged with six liters of medium. At intervals samples were withdrawn from a level between the second and third plates. The points on the curve represent the total number of units of penicillin in the fermenter at the time indicated plus the total number withdrawn previously for assays, extractions, or other purposes; thus, a drop in the curve indicates that destruction of penicillin exceeded production during the period involved.

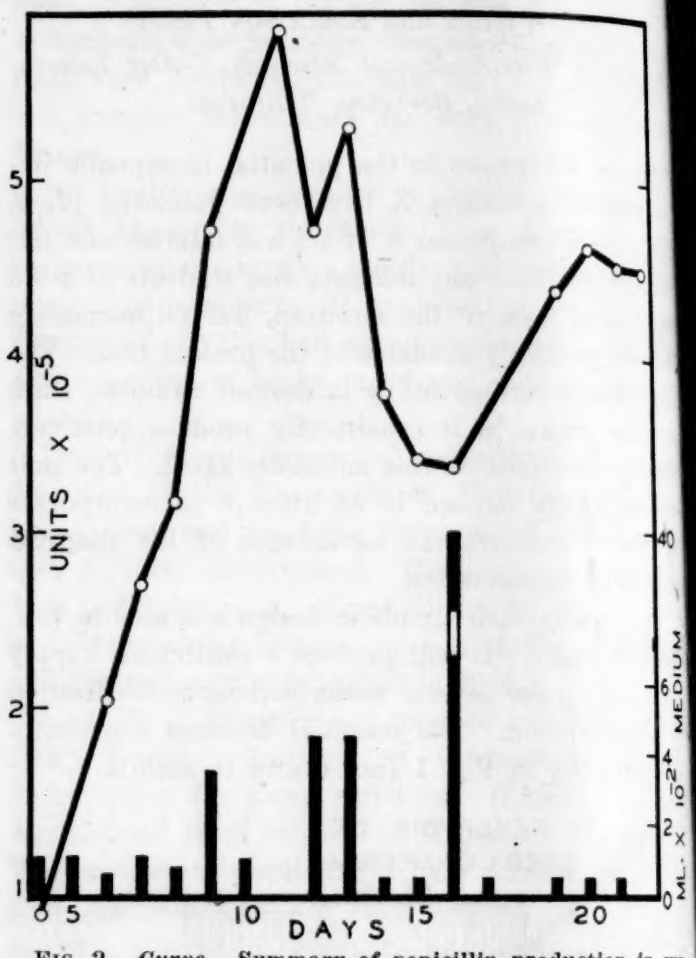

FIG. 2. *Curve.* Summary of penicillin production in run No. 7 with "submerged" surface fermenter. Ordinates show hundreds of thousands of units. *Bars.* Volume liquor removed and fresh medium added during run.

The vertical bars show the volume of liquor removed and replaced with fresh medium each day. The effect of addition of fresh medium is reflected for the first time in the assay for the following day. To facilitate visualization of this effect the bars have been displaced one day to the right on the abscissa. Thus, the volumes recorded for any given day were actually added to the culture on the preceding day.

It is interesting to note that the rapid destruction of penicillin evidenced after Day 11 was on two occasions counteracted and exceeded by increased production brought about by removal of considerable volumes of liquor and introduction of fresh medium. This experiment was discontinued at the end of the twenty-second day.

The optimum rate for removal and renewal of the culture liquor for maximum production of penicillin and of penicillin X has not yet been determined. Variables to be considered include geometry of the fermenter, particularly with respect to surface/vol-

[2] This strain is a variant of *P. notatum* NRRL 1249.B21.

me ratios, rate of aeration, temperature, strain of nold, composition of the medium, and pressure to hich the mold mat is subjected.

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A Low-resistance Valve and Indicating Flowmeter for Respiratory Measurements[1]

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In performing respiratory exchange experiments and measurements of respiratory air flow it is important that the valves for separating inspiration and expiration operate with low air-flow resistance and negligible back leakage. Dautrebande and Davies (*2*) have shown that the presence of appreciable breathing resistance in mask valves may alter the alveolar carbon dioxide concentration. Several low-resistance valves have already been described in the physiological literature, the principal ones being those of Pearce (*5*), Henderson and Haggard (*3*), and Bailey (*1*). Most of these valves may be suitable for measurements under resting or sedentary conditions but are not wholly satisfactory for working conditions when maximum air flows exceed 75 liters per minute. It is important to note that the maximum rate of air flow is specified here rather than the minute volume. The average inspiratory or expiratory air flow is approximately twice the minute volume during work, and the maximum air flows may be as high as three times the minute volume because of the shape of the respiratory air-flow curve *vs.* the time (pneumotachogram). The valve described in this article was designed primarily for experiments requiring heavy work rates and maximum effort either on a treadmill, bicycle ergometer, or hand ergometer.

In a recent article (*4*) we described a low-resistance valve (designated as a tubular valve) for use in a recording inspiratory air-flow instrument. While this valve was very satisfactory for experiments requiring low air-flow resistance and has a resistance of 0.1, 0.6, and 2.2 mm. of water at air flows of 25, 100, and 200 liters per minute, respectively, it is not entirely satisfactory when inspiratory and expiratory

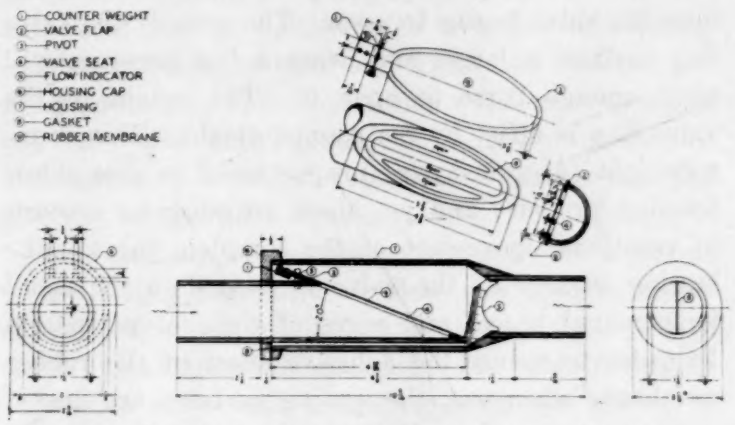

Fig. 1. Detail drawing of low-resistance valve construction.

measurements are made together because of back leakage and air-volume changes on closure. This tubular valve was designed primarily to prevent passage of expired air into the inspiratory line. The valve described below is very low in resistance and also does not have significant back leakage.

The principles involved in the operating of this valve are fundamental in the design of respiratory valves. Such valves, in order to be low in resistance, should have negligible opening pressure and should offer little change in direction so that air-turbulence losses are not induced. The valve seating surfaces should have a small contact area so that they do not adhere to each other when wet. Wet conditions in expiratory valves result from condensation of exhaled moisture upon the expiratory valve surfaces. Treatment of the seating surfaces to prevent moisture absorption and wetting aids materially, but not completely, in reducing the moisture effect; hence it is desirable to provide that such surfaces have a minimum contact area.

Construction. The details of the valve construction are shown in Fig. 1. The original models of the valve were made of brass with aluminum frames covered with rubber membranes for valve flaps and glass cylinders for valve housings. The present models are now made of methyl methacrylate resin (Lucite) plastic. The only parts not made of this plastic are the rubber membrane, the rubber housing gasket, the metal counterweight, the metal flow indicator, and the metal flap pivot. The complete valve, when made of plastic, weighs 7.4 oz. (210 grams). The chief advantages of the plastic material are its light weight and transparency. The transparent plastic allows

[1] This work was done in part under Contract No. OEMsr-306 between the President and Fellows of Harvard College and the Office of Scientific Research and Development, which assumes no responsibility for the accuracy of the statements contained herein.

close inspection of the valve while it is in operation and counting of respiration rates.

From Fig. 1 it is apparent that there are several mechanical features which incorporate the principles discussed above. It can be noted that the valve flap angle is very low (20°), and thus very little change in direction is necessary in permitting air to pass, once the valve begins to open. The area of the valve flap surface is large, and hence a low pressure will exert enough force to open it. The weight of the valve flap is offset by the counterweight. This counterweight (4 grams) was proportioned to give a low opening pressure and yet allow an adequate amount of positional movement of the complete valve. The seating surface of the valve is limited to the small longitudinal braces and edges of the seat periphery. In order to reduce the adhesive effect of the rubber membrane when wet, the seating surfaces are dusted with talcum powder. This powder prevents the rubber membrane and Lucite seating surface from wetting and also helps to preserve the membrane. The Tissot valve (*6*) also employs a hinged flap over an angular seat, but the angle with the vertical plane is very slight and the seating surfaces are metal.

The rubber membrane is very light-weight, thin, rubber sheeting having a thickness of 70 μ. This sheeting is cemented to the valve flap by rubber cement. We have found that the membranes will, in daily use, last from two to three months for inspiratory valves and one month to six weeks for expiratory valves. Severe pressure changes, such as occur at heavy work rates when resistance is introduced into the breathing line before the valve on inspiration or after the valve on expiration, do not affect the valve's efficiency. In time these pressure changes tend to stretch the membrane until it exceeds its elastic limit and does not remain plane. These changes are obviously apparent upon inspection, whereupon a new membrane can be cemented in place. The valve flap pivot consists of a small length of brass drill rod. The bearing surface is a hole drilled directly through the plastic flap slightly larger than the drill rod. No lubricant is necessary for this bearing.

The air-flow indicator feature of the valve is readily apparent from the operation of the valve. The deflection of the vane is measured by means of a small scale graduated in millimeters and made from thin sheet brass (0.25 mm.). The metal indicator scale is so thin that it does not offer appreciable resistance to air flow. This scale is primarily for the inspiratory valve, since fogging of the valve housing walls makes reading of the expiratory scale through the transparent wall rather difficult.

Valve operating characteristics. The resistance- and flow-indicating performance curves for the valve are shown in Fig. 2. As would be expected, the flow indicator curve is the same on inspiration and on expiration (aspirating and blowing air through the valve), since both measurements were made under steady flows and inertial effects are eliminated. A comparison of the two conditions under pulsating

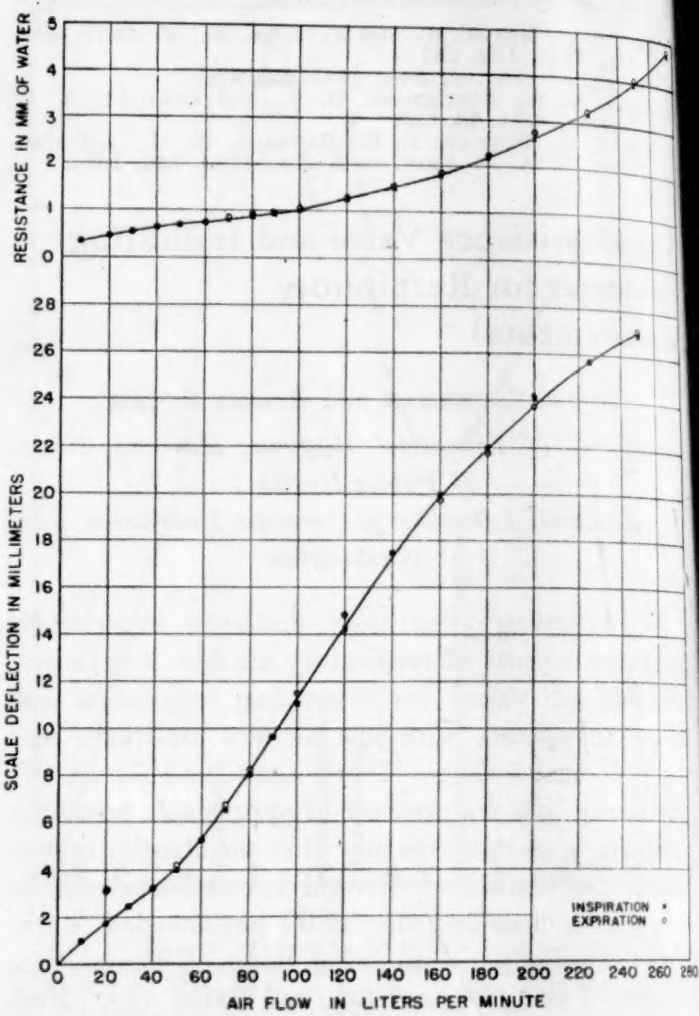
RESISTANCE IN MM. OF WATER
SCALE DEFLECTION IN MILLIMETERS
AIR FLOW IN LITERS PER MINUTE
INSPIRATION ×
EXPIRATION ○
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280

FIG. 2. Resistance and indicator characteristics of complete valve.
Lower scale—valve indicator response with increasing air flow.
Upper scale—valve resistance with increasing air flow.

flow will be given below. It can be seen from the flow-indieator curve (Fig. 2) that the counterweight is optimum for performance over the whole range of flows from 0 to 250 liters per minute. The curve is linear from 0 to 50 liters per minute and also linear from 50 to 160 liters per minute. The break in the curve at 50 liters per minute appears to be the point at which the effect of the counterweight is overcome by the pressure of the air stream. The sensitivity of the flow indicator can be increased by increasing the amount of the counterweight, but this increase will lower the air-flow range of the valve.

The resistance curve in the upper portion of Fig. 2 was obtained by aspirating and blowing air through the valve. The resistance of the valve was measured by a tap connected to an 18.9-liter plenum chamber. It was found that the resistance so measured by this chamber test gave values comparable to actual con-

tions or conditions simulating actual breathing, such a mannequin head provided with a mask and arranged so that air could be drawn into or blown into the mask cavity. In order to eliminate the entrance loss to the valve and to obtain resistance values comparable to actual use, a bellmouth or Borda mouthpiece was placed at the inlet. The valve is usually placed in a breathing line and preceded and followed by tubing. The bellmouth eliminates the necessity of a tap at the inlet of the valve when running chamber tests. When the inspiratory valve is not preceded by a recording instrument, gasometer, or other apparatus, a bellmouthed inlet should be used to reduce resistance to air flow especially at high air-flow rates. This information is not common knowledge among respiratory physiologists. When the bellmouth inlet is used, both inspiratory and expiratory resistance values agree as shown in Fig. 2. The opening pressure of the valve is less than 0.4 mm. of water, and the resistance is approximately 1 mm. of water at 100 liters per minute. Above 100 liters per minute the resistance increases exponentially, since the counterweight is overbalanced by the air flow and the orifice type of loss or exponential air-flow loss predominates. If the amount of the counterweight is increased (this can be done if increased indicator sensitivity and less stability to positional changes is desired), then the opening pressure and the resistance to air flow beyond 250 liters per minute will vary as an orifice loss, since the valve is fully opened at that rate of flow.

A comparison of the resistance of this valve with other physiological valves now in common use indicates that it is 10 to 20 per cent of their resistance above 75 liters per minute and approximately 30 per cent at lower flows. In all experiments with human subjects, when sedentary or working, no resistance to respiration could be detected when these valves were inserted into the breathing system.

The effect of the housing and the indicator scale upon valve resistance is not very significant. This is of interest because the valve can be used without the housing for expiration if it is not necessary to collect the expired air. For inspiration, however, the housing is always necessary, because it provides a means of connecting the valve to the system or mask. Above 100 liters per minute the housing adds 10 to 20 per cent increase in resistance from 150 to 250 liters per minute. The indicating scale offers no significant obstruction to air flow.

Leakage determinations on this valve were made by measuring the amount of air passing through the valve under conditions of increasing negative pressure. The range of pressures used corresponds to those which may be encountered in physiological experiments with respiratory apparatus. The valve leakage increases with increasing negative pressure, but the leakage is not appreciable (less than 25 ml. per minute) even at 40 mm. of water negative pressure. Dynamic leakage was obtained by a new method to be described later. This method measures the leakage throughout the breathing cycle by means of a new apparatus in conjunction with a respiration pump simulating actual respiration. The value obtained for dynamic leakage under conditions which correspond to sedentary and working subjects is of no significance in respiratory measurements since it is less than 0.2 per cent of the tidal volume.

The accuracy of the indicating scale as a means of estimating maximum air flow was checked under dynamic flow conditions by means of the dynamic air-flow instrument described by Lee and Silverman (*4*). The valve with indicating scale was placed in series with the air-flow instrument and several valve air-flow scale readings were noted for various volume and rate settings of a respiratory pump. The tidal volume and respiratory rate of the pump were adjusted within the range of human respiration. The indicating scale was calibrated at steady air flows, as shown in Fig. 2. A simultaneous scale reading and air-flow photographic record were taken for four or more respirations for each inspiratory and expiratory air-flow condition.

From these measurements it was observed that the indicator scale will give maximum flow readings to within 10 per cent, based on the mean of five or more observations. At high respiration rates the error of the valve indicator increases because of the greater inertia effect. The fact that almost all valve readings are greater indicates that inertia is present. At very low respiration rates this inertia may reduce the readings below the true air flow. There does not appear to be any significant difference between inspiratory or expiratory measurements although, as mentioned above, expiratory measurements on human subjects are difficult because of fogging of the valve housing by condensation of expired moisture. Simultaneous measurements were also made on a sedentary human subject who voluntarily controlled his breathing. These measurements gave comparable results to the pump measurements.

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Letters to the Editor

Degradation of Streptomycin and the Structure of Streptidine and Streptamine

Recently the degradation of streptomycin to a diguanido base (streptidine) and the corresponding diamino compound (streptamine) was described, and evidence was presented that streptamine is either a 1,3- or 1,4-diaminotetrahydroxycyclohexane (*Science*, 1946, 103, 53–54). Convincing data have now been obtained supporting the former structure. Oxidation of N,N-dibenzoylstreptamine with periodate yields a substituted five-carbon dialdehyde (I) (m.p. 130–131° C.) which appears to exist in a hydrated cyclic form (1,3,5-trihydroxy-2,4-dibenzoylaminotetrahydropyran). The triacetyl derivative of I is a beautifully crystalline substance (m.p. 217° C.). Oxidation of I with bromine water yields a dibenzoylaminohydroxyblutaric acid (m.p. 197–198° C.). These products are to be expected from 1,3-diaminotetrahydroxycyclohexane but not from the 1,4-diamino isomer. Hence, these data, in conjunction with the previously presented evidence, establish the structure of streptamine as 1,3-diamino-2,4,5,6-tetrahydroxycyclohexane. Streptidine is the corresponding 1,3-diguanido compound.

Streptamine is optically inactive and probably represents one of the eight possible *meso* forms. Correlation of the configuration of streptamine with that of *meso* inositol is an interesting problem with which we are now engaged.

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Noyes Laboratory of Chemistry, Urbana, Illinois

Scientific Research and National Welfare

H. S. Reed (*Science*, 1945, 102, 524) apparently writes in behalf of the Executive Committee of the Pacific Division of the AAAS and makes certain statements to which one might take serious objection. The conclusion of his letter reads as follows: "For the first five years the Board of Research and Development could utilize existing laboratories. No greater mistake could be made than to spend large sums at present in the construction of Federal laboratories. It would be much better to make grants of funds to private industrial laboratories or educational institutions under the supervision of the Board of Directors. It will take nearly five years for the board to prepare an adequate program for research. In its essence, men and their intellects are the important things in research rather than lofty buildings. I am not in favor of having the research funds spent in the existing laboratories of the Federal Government because I do not believe that there are now men in those laboratories who are capable of directing basic scientific researches, except in a few cases."

The undersigned, in the belief that the somewhat unfortunate wording of the above statement was not intended to be taken literally, is writing this letter for the purpose of clarification of the terminology used, in hope that this clarification will have sufficient circula through the medium of *Science* to rectify the u tunate impression which a misunderstanding of te nology implies.

As a pure academic scientist, the undersigned (in capacity as reserve officer in the U. S. Navy) has b closely associated with aspects of the problem of nati scientific welfare in connection with national defe In an attempt to clarify this problem the undersig published an article entitled "Naval research in pe and war" (*Proc. nav. Inst.*, 1945, 71, 1169). In t article some clarification of the terminology and t necessity for adequate support of Federal research la ratories for national defense were set forth in detail. what follows the essence of this analysis, pertinent Prof. Reed's letter, is presented with the hope that will serve to clarify the situation:

What Dr. Reed and many others do not appreciate that there is much more to the question of industri and national defense research than is implied in th pure scientists' view of research. The undersigned ha chosen to classify three aspects of the scientific researc as it affects national welfare. These are: (1) the pur or *fundamental research* which leads to an understand ing of the laws of nature, the discovery of new fact and laws, and the theoretical development of that knowl edge; (2) the *basic research* as it applies to industria or military development involving basic studies of th fruits of fundamental work to determine their poten tialities antecedent to application; (3) the *applied re search* and development.

Each of these phases is essential to national welfare, and each has its own specific requirements and qualifications. Thus, *fundamental research* must be unrestricted as to problems, mode of attack, scope, freedom of publication, etc. It is vital to the country's welfare, for whatever nation is paramount in *fundamental research* will also excel in the other phases. The logical place for this work is primarily in the academic environment and perhaps in a few specially equipped industrial and government laboratories. Primarily, government laboratories are intended to furnish research of types *more immediately* profitable to the Nation's needs and welfare, which must in some degree limit the amount of the often wasteful effort which goes into pure or *fundamental research.*

Basic research is usually somewhat more expensive. It requires larger fields for application and test and is definitely the concern of academic engineering schools, industrial laboratories, and the Federal Government laboratories. It perhaps should not have too many restrictions on freedom of effort, method of attack, and freedom of publication. However, in many questions vital to the Nation's welfare there may be urgent need for secrecy or classification. This point is often over-

Such classified research is inimical to the spirit ademic institutions. Because of this influence as s the difficulty in maintenance of security, except academic engineering field where free publication d be required, this work should not be done in such utions.

applied research and development of devices is usly the sole concern of industry and the Federal rnment. It is far too costly to be carried out in emic centers and is definitely of utilitarian import. of this material can and must be published, at itious stages of development. Other aspects of this both in industry and the Government, must be kept icted for security purposes. The writer, being iliar with the defense aspects of the problem as it ts the Navy, is convinced that while part of the *research* on such measures can be farmed out to stry, it is essential for security reasons as well as the proper development of the devices that such k be carried out in laboratories directly under the ncies involved.

This statement follows, since the industries are not rated directly for the public and have their own erests and problems, and is based on experience. The d of Federally controlled laboratories applies equally *basic studies* such as those carried out by the National reau of Standards and the U. S. Department of Agriture, irrespective of whether the material is classified not. Experience has shown that under these conions the only solution is to endow the national defense encies and other Federal agencies charged with specific oblems sufficiently to insure the national welfare. Such dowment and support is vital to the national welfare d must receive its share of support with other research tivities.

The undersigned cannot agree with the statement of r. Reed in saying: "I do not believe that there are now en in those laboratories who are capable of directing asic scientific researches, except in a few cases." This quite contrary to the experience of the writer, which as been far from limited, even if the writer's term "fundamental" replace the word "basic." There are many highly able and brilliant research men capable of fundamental research work in these laboratories. That they have not done much work of this character results from the fact that they are employed for other purposes and do these well.

It is admittedly true that Federal scientific agencies have suffered under severe handicaps in the past, such as low salaries for the more highly placed technical personnel, difficulties in employment conditions by Civil Service restrictions, and budgetary restrictions. These are conditions that should, and will, be improved. However, it does not assist in improving the situation or in encouraging good men to assist in the necessary Federal Government conduct of research to have such statements as those of the Executive Committee of the AAAS broadcast.

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Temperatures in Deep Wells and the Ice Age

In *Science* (1945, 102, 334–335), the writer published an article entitled "Temperatures in some deep wells in Pennsylvania and West Virginia." A study of the data indicates that, in general, the rate of increase in degrees Fahrenheit, per unit increase in depth, becomes greater.

It has been suggested that the lower temperatures of the recent ice age might be responsible for this phenomenon. The tundra regions of the high latitudes in Asia and North America are frozen, at present, to depths of hundreds of feet and in northern Siberia to a thousand feet or more. The wave of low temperatures of the ice age may be working its way to still lower levels. It is reasonable to suppose that a large area in the United States, during the ice age, was frozen to considerable depth. This might explain the lower rate of increase in temperature per unit of depth nearer the surface than at greater depths.

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Consultant Articles

The purpose of this letter is to suggest a method by which scientific evidence may be tested to determine its validity. It is a common observation that some long-established misconceptions may prevent the acceptance of new observations and thus impede the progress of science. Granting this to be true, science needs fact-finding boards to determine whether or not the evidence presented is sufficient to support a new hypothesis.

The discussion of scientific reports at meetings may air a subject to a certain extent, but generally this is inadequate to test the correctness of new evidence. Those workers who might be able to judge the results rarely express a definite opinion because they wish to have more time for thought and possibly for experimentation. After leaving the meeting, their own problems again occupy all their attention, and so acceptance of a new concept may be delayed year after year.

The "consultant article" appears to offer a solution. By this means an investigator who decides to submit his observations to a searching analysis can determine whether or not evidence supporting his hypothesis meets the approval of authorities in his particular field.

The method of setting up consultant articles has been used in various forms in the *Journal of Dental Education*, in which more than 30 such articles have appeared since 1939. Even textbooks lend themselves to this method of authoritative presentation. B. Orban, together with 18 other authors, prepared a work (*Oral histology and embryology*. St. Louis: C. V. Mosby, 1944) in which each chapter was written by an authority, the entire text then being submitted to all authors a number of times for revisions, additions, and deletions.

Experience has shown that the author of a consultant article must present his evidence clearly and briefly. The principal issue must be focused definitely to limit discussion to major data. This can be done by referring a number of questions to the consultants which

are pertinent to the controversial material. These questions should be so phrased that they require definite answers, such as "yes," "no," or "possibly true." When a consultant answers in the negative, he is asked to present evidence to support his contrary opinion. The discussion of consultants may be rounded out further by including their opinions of the paper as a whole and stating their approval or disapproval.

The number of consultants necessary to present a good discussion varies. Usually 5 or 6 are sufficient, although the discussion concerning a generally held misconception may require as many as 15 or 20 consultants. After conference with the author, consultants are selected by the editor of the periodical in which the article is to be published. If the author selected as consultants only those whose views agreed with his, he would defeat his purpose. He must consider authorities of contrary opinion a well as those in agreement with him. It is clear that the opinion of the readers will depend greatly on the previously published views of the consultants. The principal purpose of consultant articles is to ascertain whether or not the available evidence is sufficient to convince those men who, in the past, have held contrary views.

When all consultants have submitted their discussions, the author has the privilege of answering their criticisms. He often finds this opportunity highly instructive. The author may note that (1) a certain phase of his evidence is not quite as conclusive as he believed; (2) the evidence was unknown to some consultants; (3) some of his statements have been misinterpreted by consultants due to lack of clarity; (4) photomicrographs, charts, graphs, or other material used as evidence supporting his findings were insufficient in number or not sufficiently clear to gain conviction. All of these data may be discussed by the author in order to interpret and correlate all opinions. The closing discussion should be brief, yet sufficiently comprehensive to allow the busy reader to glean from this concluding statement an idea of the status of this controversial subject.

Past experience has shown that consultant articles can be made highly authoritative and instructive. By means of cooperation between the leaders in specialized fields, obsolete material may be eliminated more rapidly and the value of new hypotheses tested, resulting in the more rapid progress of science.

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Research Service Laboratories

As research grows more specialized the methods used become more complex, and progress in one field is increasingly dependent on advances in knowledge and techniques in other fields. Scientists find it increasingly difficult, however, to keep informed concerning current developments in their own fields, and practically impossible to keep up with advances in other fields. Thus, it seems that just at the time when our dependence on other fields is increasing, our ignorance of them is heightening. This situation emphasizes the importance of cooperation and consultation between departments. The advantages of being able to consult with competent advisers concerning the planning of efficient experiments and the construction of reliable apparatus are obvious to all who have ever developed research programs. Much time and money are wasted trying to improvise apparatus because no expert is available to give advice or to build reliable apparatus. Probably even more time and money are wasted on poorly designed projects which yield inadequate and inconclusive results, but which, if properly planned, would have yielded satisfactory results with the expenditure of less time and money.

While we usually find our colleagues in other departments willing to advise us, we generally consult them with some reluctance because we know that they could spend their time more profitably on their own problems. This situation might be remedied by the establishment of what Klopsteg calls "laboratories of instrumentology" to assist investigators in developing better methods and apparatus for research (*Science*, 1945, 101, 569). The program proposed by Klopsteg is too elaborate and too expensive for any but the largest universities, but much can be done to increase the efficiency of research in institutions of moderate size by supplying a few of the more essential services.

Perhaps the most useful service is an adequately equipped instrument shop, supervised by an ingenious and cooperative instrument maker. In view of the increasing use of electronics and electrical instruments of all sorts, a consulting physicist with special training in electricity and electronics is highly desirable. The services of a glass blower are often needed, but individual conditions would determine whether or not an institution of moderate size can afford a full-time man. One solution is for two adjacent institutions to cooperate by sending all their work to a shop maintained by one of them. Another essential service is a statistical laboratory in charge of an expert in the design of experiments and the analysis and interpretation of data. Such a consultant can add greatly to the efficiency of research by eliminating the waste of time and money resulting from poorly planned experiments. While most investigators have a fair knowledge of experimental techniques, few have had adequate training in planning experiments and evaluating the reliability of data. Various other forms of service can be developed to fit the needs of research in particular institutions.

Probably most institutions have some of the services mentioned, but in only a few instances are they specifically organized to serve investigators in all departments. Service laboratories should ordinarily be administered by the departments to which they are naturally related. Investigators using them should be charged for the time and materials used on their projects. Free services are never as much appreciated as those which must be paid for, and a charge prevents a few self-centered individuals from completely monopolizing the services of a laboratory.

It should be emphasized that the success of such laboratories depends largely on the training and personality of the men in charge. Not only must they be well informed in their own fields, but they must have broad interests, ingenuity, curiosity, and a real desire to cooperate with their colleagues in other fields in solving a wide variety of problems.

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On Introductory Biology Courses

In the recent discussion of the nature of the elementary course in biology reported by Dr. Hamburger (*Science*, 1945, **102**, 511–513), consideration was given to the problem of whether a single course in general biology should be given for all students, general and professional, or whether a special course should be set up for the latter. At Stanford University both methods have been tried, and the author has taught under both plans. The staff has been sufficiently large to allow two introductory courses, so the choice has depended upon the performance of the students. Our plan and experience might therefore be of interest to others.

Stanford was one of the pioneers in giving a general biology course designed primarily for the liberal arts student and organized along lines quite different from the classical courses in botany and zoology (L. L. Burlingame and E. G. Martin, *Science*, 1920, **51**, 452–455). This course and its successors have used the principles of biology and their corollaries as the basis of organization. Thus, the broader concepts of biology are emphasized as the basis of an understanding of the functioning of the human body and the place of man in nature as one of the animals in a community of organisms.

On the other hand, such a course, while excellent for the liberal arts student, may not necessarily be the best beginning for the person who, by virtue of high school training or a strong interest in organisms awakened in some other way, already has a fair understanding of the general concepts and is anxious to begin directly on his professional training. In two attempts to put all students together—majors in biology, premedical and liberal arts students—we have had this brought to our attention strikingly. The pace necessary for the newcomer is too slow for the student already introduced to biology. The repetition of the same material as he had in high school is not most stimulating to him. On the other hand, accelerating the course or making it more intensive soon carries it beyond the ability of the newcomer. Segregation of the majors and premedical students into a special advanced laboratory section helps but does not solve the problem, for the lectures are still aimed mainly at one group. As a result of these experiences the professional and premedical students were allowed to elect plant and animal biology instead of general biology. This most of them did, although some, feeling the need of orientation, took general biology. Both routes are allowed to serve as an introduction to the advanced professional courses.

In the introductory plant and animal biology courses the plan has been to introduce the student to the major plant and animal groups, their behavior, nutrition, structure (gross and histological), life cycles, and evolution. In so far as is feasible, principles of adaptation, distribution, homology, recapitulation, evolution, and heredity are considered when the material favors their discussion, and the cell theory serves as a unifying principle throughout.

The professional and premedical student does not receive adequate training in all the principles of biology in his introductory plant and animal biology courses, since time is inadequate for this purpose. On the other hand, by the time he finishes a good advanced sequence in his professional field he will have been introduced to all the principles of biology, each strongly reinforced by a body of data far in excess of that possible in the general biology course. If he still needs a general treatment of the principles of biology and their application to man, a course on the senior level, encouraging him to focus his attention on the principles and to weld these into a philosophy of biology, might serve his needs far better than time taken out at the elementary level.

Such a double entry into biology may require more staff, and it taxes the type of adviser who wishes to rubber-stamp all college entrants. Inasmuch as the entrants are diverse in ability, background, and training, why not recognize and take advantage of this diversity as well as of the differences in objectives and subsequent training an individual is to receive? While all members of our own staff are not in complete agreement on this arrangement, practice has borne it out as preferable under local conditions. It would be interesting to know the experience of others in this regard.

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Support of Scientific Research

In reading the various interesting and stimulating discussions of different aspects of the proposed national legislation for the support of scientific research, there is one phase of the problem that seems to me to have been largely, if not entirely, overlooked. This is the educational value to a democracy derived from the individual support of such work. There has been a well-organized effort in this country to emasculate the emotional and participative factors in individual charity and philanthropy.

Community chests with pooled and budgeted objectives are undoubtedly, on paper, an efficient method of giving. By the conduct of a single campaign covering many needs it effectively obviates the necessity of the donor investigating and considering the individual needs. It is a soporific to individual responsibility and tries to make giving an easy and comfortable process devoid of any unpleasant realities that make the donor even temporarily uncomfortable. It kills thought and, with

thought, imagination. It attempts to do for charity toward one's neighbor what many of the organized religions have done to man's thoughts about a deity, namely, make them less a personal and more an organizational responsibility.

Support of education and of research by taxation is much the same sort of process. One's taxes are rarely itemized in proposed expenditure although analyzed *ad nauseam* in origin of income. When one's Federal taxes are paid, personal interest in their expenditure promptly and unfortunately ceases for the average man unless some flagrant abuse or scandal is later unearthed or unless they are abruptly or extensively increased.

This country sorely needs more, rather than less, individual appreciation of its educational and research problems. It can gain this end best by forcing greater rather than less, individual participation in raising funds for these purposes.

The experience of the American Cancer Society is a large enough example of this principle to be significant and impressive. This Society has long recognized that cancer obviously and insistently requires individual responsibility, knowledge, and action for its ultimate conquest. The Society has gone far along the road toward arousing the American public to its essential part in the fight against this disease. The effort has required time, hard work, and faith in the average American citizen. It has, however, begun to prove its soundness by the results already obtained, and its permanency by the increased evidence of autocatalytic increase in interest by the public.

A democracy which could and did obtain its support of scientific research in the same way would send the roots of intelligent, personal giving deep into the soil of its citizenry. These roots in turn would make that soil more porous to education and more fertile in contributing succeeding generations of better-equipped and more cooperative men and women who would understand more completely and naturally their duties as citizens of a free state.

Government support of research involves no new principle. It has a long and distinguished record of achievement to its credit. It can well be greatly extended and broadened. It is only when it becomes too regimented, circumscribed, or handicapped by administrative methodology that it becomes dangerous in just the same way that these same impersonal and overorganizational factors can endanger individually supported research.

There is a very real place for government support of research but it might well be in cooperation with increased private and individual effort. Neither system alone is as strong as a combination of the two, for when both exist together there is a chance to compare the results and to supplement one another where mutual interests are involved. Each can learn by the mistakes of the other. Each can use the experience as a valuable "laboratory course" in the relationship between individual and Federal responsibility.

The main point is that both governmental and private support of research need and must have a continuing individual educational emphasis so that both may constantly be more intelligently and universally supported by citizens who know what they are supporting and why.

The time to establish this principle is now. If we delay we shall find it increasingly difficult to introduce it at a later date.

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Book Reviews

Pulmonary edema and inflammation. Cecil K. Drinker. Cambridge, Mass.: Harvard Univ. Press, 1945. Pp. viii + 106. (Illustrated.) $2.50.

This book is of particular importance because it is the only publication at present available in which the factors involved in the excessive accumulation and distribution of fluid within the pulmonary system are presented. Observations based on experimental technics devised by Drinker, Warren, and their associates for determining quantitatively the pulmonary lymph flow in the dog form the groundwork for a discussion of the mechanisms of pulmonary edema and its treatment. Four of the five chapters are based on the Nathalie Gray Bernard Lectures given by Dr. Drinker at the Bowman Gray School of Medicine. A fifth chapter on artificial respiration completes the book.

The anatomy and physiology of the lung are discussed in relation to transudation. It is pointed out that the pulmonary capillaries, unlike all other capillaries, depend for their oxygen supply on air reaching the individual alveoli and not on arterial blood. The presence of fluid in the alveoli or bronchioles excludes air and thereby produces anoxia of the involved pulmonary capillaries. Experimental observations in the dog are presented in detail and interpreted to show that anoxia produces excessive leakage of fluid from the pulmonary capillaries, whereas increased capillary pressure does not readily cause recognizable pulmonary edema. The pulmonary lymphatic system in the dog is extensive and drains into the right subclavian vein by way of the right lymphatic duct. The right lymph duct is small and limits the rate of pulmonary lymph flow. A new drug, related to thiourea, which is capable of producing pulmonary edema was used to demonstrate the inadequacy of the lymphatic

system in the dog as a means of removing excessive amounts of fluid from the lung. Variations in lung movement and expiratory and inspiratory resistances were found to affect the rate of pulmonary lymph flow. There is an excellent critique of various methods of artificial respiration in which a strong stand is taken against the use of mechanical resuscitators.

Dr. Drinker recommends the administration of oxygen under higher than atmospheric pressure for the treatment of pulmonary edema, on the ground that the added pressure will oppose filtration from the pulmonary capillaries. To this reviewer it does not appear that the application of the recommended 6 cm. of water pressure at the mouth of a patient will oppose capillary filtration to a significant degree. We have found that the pressure available for opposing capillary filtration cannot be assumed to be equal to that applied at the mouth, since roughly half of the applied pressure is transmitted to the intrapleural space, this transmitted portion increasing the pressure in the pulmonary artery and vein. It is improbable that the resulting pressure increase, which would amount to 2 to 3 cm. of water, would exert significant counterpressure to oppose capillary filtration.

A discussion of the pathogenesis of pulmonary edema in man is a difficult one to write at this time, because blood pressure in the pulmonary capillaries, oncotic pressure of the plasma proteins in the pulmonary circulation, and tissue tension have not been measured quantitatively in man, nor are the factors governing variations in the passage of fluid through the capillary wall understood. Perhaps the application of the right heart catheterization technic in man will be productive of significant quantitative data on pressure relationships in the lesser circulation in relation to the problem of pulmonary edema. Dr. Drinker has performed a difficult task well. *Pulmonary edema and inflammation* is stimulating and fills a gap in medical literature. The book is highly recommended.

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Insect dietary: an account of the food habits of insects. Charles T. Brues. Cambridge, Mass.: Harvard Univ. Press, 1946. Pp. xxvi + 466. (Illustrated.) $5.00.

In this book the author presents an account of the food habits of insects which is very comprehensive in coverage and quite readable. Each chapter is supplemented with an excellent bibliography of the special subject under discussion, thus bringing together a great many resources for the student of insects not hitherto of easy access.

The book does not, as might be expected from the title, go into the chemical phases of insect food or into insect metabolism, which might have interested some students more, but which would have made the book less interesting to the inquirer about insect food habits. The chapter on abundance and diversity of insects assembles many estimates of insect populations under diverse specific conditions. The stupendous numbers per acre in many of these estimates would be hard to believe if they were not the conscientious estimates of many observers. Dr. Brues then proceeds to analyze the food habits in relation to structure and environment, follows with separate chapters on the herbivorous insects, the gall makers, and the predators and parasites. An interesting chapter is that on the use of fungi and microbes as food of insects, and the insect symbiosis with such microorganisms. This is a subject seldom treated in textbooks, and consequently the long bibliography will be of great use. The parasitic insects are divided into the external parasites of vertebrates and the internal parasites of insects and vertebrates. The final chapter considers the insects as food of microorganisms, of insectivorous plants, and of lizards, amphibians, birds, mammals, and man.

On the whole, this is a very useful book, packed with information and references to stimulate further research. It will be invaluable to lecturers.

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Dvorine color perception testing and training charts. (Vol. I: Testing charts; Vol. II: Training charts.) Israel Dvorine. Baltimore: Israel Dvorine, 1944. $25.00.

This work consists of two volumes of color plates and a brief pamphlet of instructions. Although the jacket states that these are "the first set of pseudo-isochromatic charts developed by an American," the construction of the plates follows that of the Ishihara, Rabkin, and Stilling plates, retaining most of their faults but lacking valuable diagnostic features of the older plates. It appears that the fundamental researches of the last half century, including those of Pitt, Wright, and Judd, have been ignored.

The Introduction states: "The colors of these charts are based on the subtractive color theory; that is, that the primary colors are red, yellow and blue. . . ." This is a useful working principle for mixing printing inks, but it bears no relation to the design of a color system which diagnoses color blindness.

The claim that the system "selects individuals who are not color blind but who merely become visually confused by certain color combinations" is a dangerous play on words. The Navy, for instance, cannot afford to use men who "visually confuse" red and green light signals.

It is claimed that the second volume is useful in the training of color vision. There is no doubt that men can be "trained" to improve their scores on pseudo-isochromatic tests, but there is no indication that men are less color blind as the result of such training. Rather, this proves that such tests are defective as measuring instruments. The net result of the present widespread teaching of "how to pass the plates" is merely that better and less learnable methods for testing color vision will be developed and substituted.

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Scientific Book Register

ABT, ISAAC A. *1945 year book of pediatrics.* Chicago: Year Book Publishers, 1946. Pp. 448. (Illustrated.) $3.00.

ALEXANDER, JEROME. (Ed.) *Colloid chemistry: theoretical and applied.* Vol. VI: *General principles and specific industries; synthetic polymers and plastics.* New York: Reinhold, 1946. Pp. vii + 1215. (Illustrated.) $20.00.

AMSDEN, JOHN PAGE. *Physical chemistry for premedical students.* (1st ed.) New York-London: McGraw-Hill, 1946. Pp. ix + 298. (Illustrated.) $3.50.

BARBOUR, THOMAS. *A naturalist's scrapbook.* Cambridge, Mass.: Harvard Univ. Press, 1946. Pp. x + 218. (Illustrated.) $5.00.

BENSON, LYMAN D., *et al. Manual of trees and shrubs of the southwestern desert.* Tucson: Univ. Arizona, 1945. Pp. 411. (Illustrated.) $3.00.

BROSTER, L. R. *Endocrine man: a study in the surgery of sex...* New York: Grune and Stratton, 1945. Pp. xi + 144. $3.50.

BUNN, C. W. *Chemical crystallography: an introduction to optical and X-ray methods.* Oxford, Eng.: Clarendon Press, 1945. Pp. xii + 422. (Illustrated.) $7.50.

CABLE, EMMETT JAMES; GETCHELL, ROBERT WARD, and KADESCH, WILLIAM HENRY. *Science in a changing world.* (Rev. ed.) New York: Prentice-Hall, 1946. Pp. xvii + 622. (Illustrated.) $5.00.

CAHN, LESTER, *et al. The 1945 year book of dentistry.* Chicago: Year Book Publishers, 1945. Pp. 703. (Illustrated.) $3.00.

COOK, ROBERT, and BURKS, BARBARA S. *How heredity builds our lives: an introduction to human genetics and eugenics.* Washington, D. C.: American Genetic Association, 1946. Pp. 64. (Illustrated.) $.75.

CORNETT, R. ORIN. *Algebra: a second course.* New York: McGraw-Hill, 1945. Pp. 326. (Illustrated.) $2.00.

DARLINGTON, C. D., and AMMAL, E. K. JANAKI. *Chromosome atlas of cultivated plants.* London: George Allen and Unwin, 1946. Pp. 397. $2.75.

DEGENER, OTTO. *Plants of Hawaii National Park illustrative of plants and customs of the South Seas.* New York: New York Botanical Garden, Bronx Park, 1946. Pp. 329. (Illustrated.) $2.50.

DE MENT, JACK. *Fluorochemistry: a comprehensive study embracing the theory and applications of luminescence and radiation in physicochemical science.* Brooklyn: Chemical Publishing Co., 1945. Pp. xvii + 796. (Illustrated.) $14.50.

DOUGHERTY, JOSEPH M., and LAMBERTI, ANTHONY J. *A textbook of bacteriology and immunology.* St. Louis: C. V. Mosby, 1946. Pp. 360. (Illustrated.)

DUNBAR, HELEN FLANDERS. *Emotions and bodily changes: a survey of literature on psychosomatic interrelationships, 1910–1945.* (3rd ed.) New York: Columbia Univ. Press, 1946. Pp. 663. $7.50.

FARRELL, JOHN T., JR. *Roentgen diagnosis of diseases of the gastrointestinal tract.* Springfield, Ill.: C. C. Thomas, 1946. Pp. 271. (Illustrated.) $5.50.

FISHER, DOUGLAS A. (Compiler.) *Steel in the war.* New York: U. S. Steel Corp., 1946. Pp. 164. (Illustrated.)

FORD, CLELLAN STEARNS. *A comparative study of human reproduction.* (Yale Univ. Publ. Anth., No. 32.) New Haven: Yale Univ. Press, 1945. Pp. 111. $1.50.

GRANT, JULIUS. (Ed.) *Quantitative organic microanalysis: based on the methods of Fritz Pregl.* (4th English ed.) Philadelphia: Blakiston, 1946. Pp. vii + 238. (Illustrated.) $5.00.

HARDENBERGH, WILLIAM ANDREW. *Water supply and purification.* (2nd ed.) (International texts in civil engineering.) Scranton, Pa.: International Textbook Co., 1945. Pp. 502. (Illustrated.) $4.00.

HEADLEE, THOMAS J. *The mosquitoes of New Jersey and their control.* New Brunswick, N. J.: Rutgers Univ. Press, 1945. Pp. x + 326. (Illustrated.) $4.00.

HEITLER, W. *Elementary wave mechanics.* Oxford, Eng.: Clarendon Press, 1945. Pp. viii + 136. (Illustrated.) $2.25.

HOFFMAN, ADOLPHE. *Faune de France 44: Coléoptères bruchides et anthribides.* Paris: Paul Lechevalier, 1945. Pp. 184. (Illustrated.) 250 fr.

HOPKINS, B. SMITH, and BAILAR, JOHN C., JR. *Essentials of general chemistry.* Boston: D. C. Heath, 1946. Pp. v + 520. (Illustrated.) $3.50.

KEYS, THOMAS E. *The history of surgical anesthesia.* New York: Schuman's, 1945. Pp. xxx + 191. (Illustrated.) $6.00.

LEFFINGWELL, GEORGIA, and LESSER, MILTON. *Soap in industry.* Brooklyn: Chemical Publishing Co., 1946. Pp. viii + 204. $4.00.

LEWIS, NOLAN D. C., and PACELLA, BERNARD L. (Eds.) *Modern trends in child psychiatry.* New York: International Univ. Press, 1945. Pp. 341. (Illustrated.) $6.00.

MUMFORD, LEWIS. *Values for survival: essays, addresses, and letters on politics and education.* New York: Harcourt, Brace, 1946. Pp. x + 314. $3.00.

RICHTER, VICTOR VON. (Edited by Richard Anschütz.) *The chemistry of the carbon compounds:* Vol. III: *The aromatic compounds.* (3rd English ed.) New York: Elsevier Publishing Co., 1946. Pp. xviii + 794. $15.00.

SÉGUY, EUGÈNE. *Faune de France 43: insectes ectoparasites (Mallophages, Anoploures, Sephonaptères).* Paris: Paul Lechevalier, 1944. Pp. 684. (Illustrated.) 800 fr.

SNYDER, LAURENCE H. *The principles of heredity.* Boston: D. C. Heath, 1946. Pp. xvi + 450. (Illustrated.) $3.75.

SOLOMON, ARTHUR K. *Why smash atoms?* (Rev. ed.) Cambridge, Mass.: Harvard Univ. Press, 1946. Pp. xii + 204. (Illustrated.) $3.00.